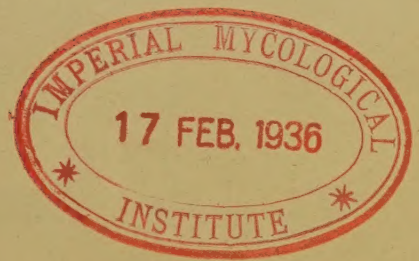


EMPIRE COTTON GROWING CORPORATION

PROGRESS REPORTS FROM
EXPERIMENT STATIONS
SEASON 1934-1935



Price 2s. 6d., post free

LONDON

1936

**PROGRESS REPORTS FROM EXPERIMENT
STATIONS, SEASON 1934-1935.**

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PREFACE

It is hoped that the accompanying collection of Progress Reports from Experiment Stations at which work on cotton is being carried on will be found to fulfil their primary purposes, which were started in the Preface to last year's volume—namely to serve as a brief record of the work accomplished at each Station during the past year, and to provide information for workers on similar subjects at other Stations.

The writers of the Reports on the last season's work have clearly kept in view the main lines which were suggested by the Conference on Cotton Growing Problems held in 1934. Thus, details of procedure and technique have not, for the most part, been included, save in cases where they may be thought to be helpful to other workers. On the other hand, there still appears to be a tendency in some reports to give the names of the localities where various trials were carried out, which have as a rule only local importance, and to include a list of all the strains included in each trial. Since these consist frequently of numbers alone they can convey little to workers elsewhere, and it is suggested that it would suffice if the names or numbers were given of those strains only that have shown themselves to be outstanding in one respect or another. This would provide all the information required by those workers who, on the strength of the performance of a certain strain, wish to ask for a small quantity of seed for trial in their own country.

But the most hopeful source from which suggestions for improvement in the form or contents of these Progress Reports are likely to be forthcoming are the authors themselves and their fellow-workers, and the Corporation would naturally be only too pleased to give careful consideration to any such suggestions, with a view to asking the authors to adopt them next year, if they commend themselves generally.

A valuable addition to the volume is the Reports from the Stations in Northern and Southern Nigeria respectively, and the Corporation are glad to avail themselves of the opportunity of thanking the Government of Nigeria for their co-operation in forwarding them for inclusion with corresponding Reports from other cotton-growing countries.

QUEENSLAND
COTTON RESEARCH STATION, BILOELA.
PROGRESS REPORT FOR THE SEASON 1934-35.

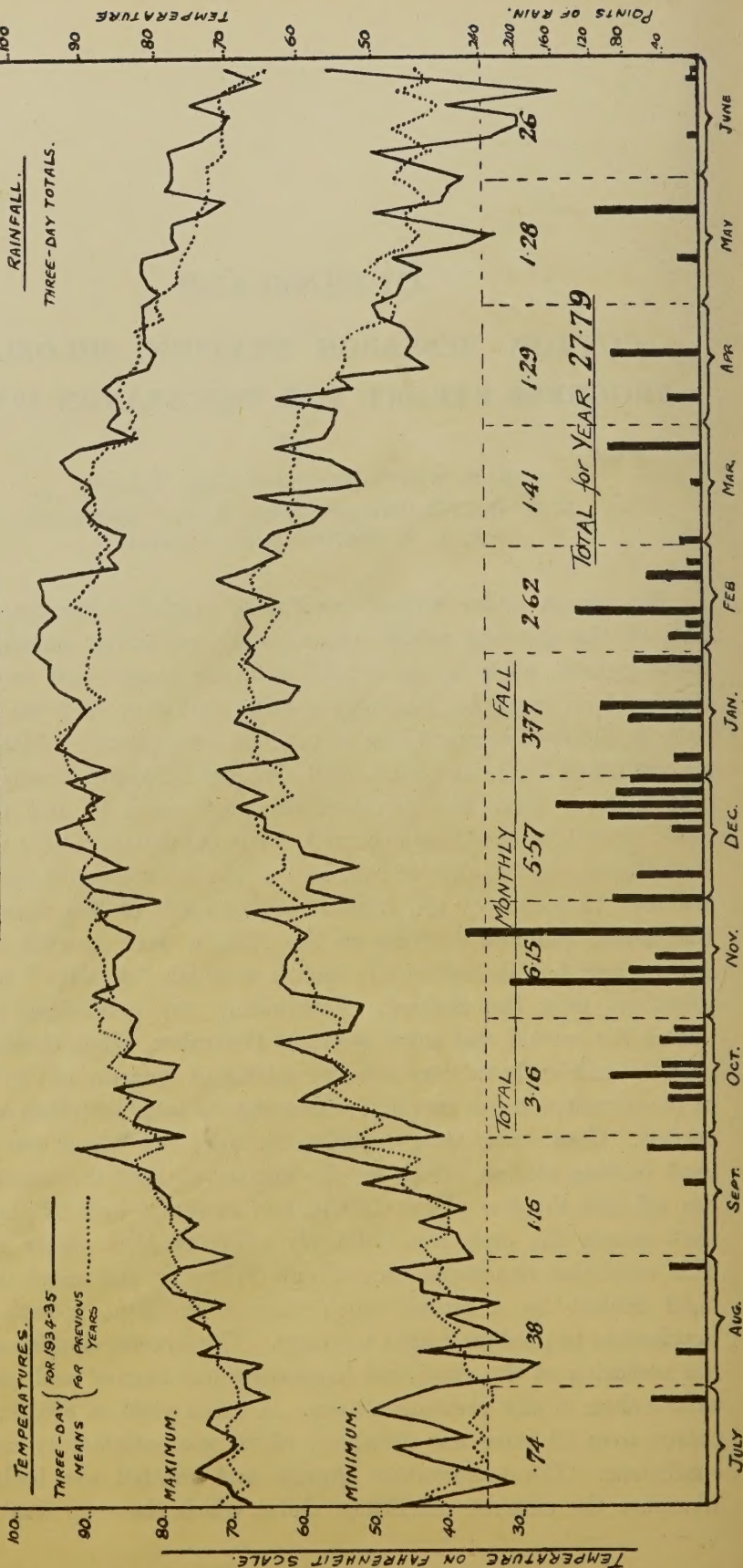
BY

W. G. WELLS (Director of Cotton Culture),
L. M. HODGE (Manager), Cotton Research Station, and
W. A. R. COWDRY (Field Assistant).

The season under review was one of marked contrasts, the first half of the growing period experiencing conditions causing rather rapid growth, while in the second half, the plants were so severely checked by a long spell of hot dry weather that a top crop was produced only in the depressions where water had accumulated. Planting was accomplished from the 18th to 24th October following storms totalling 1.43 inches. Excellent germinations were obtained and extremely rapid growth of seedlings occurred. The combination of 9 wet days, contributing 6.15 inches of rain and a marked increase of nitrates in the first 12 inches of soil caused rapid growth of the plants during November, thinning starting on the 19th, a week quicker than last season, and by the end of the month a tallish "spindly" plant was prevalent over the Station. Fortunately dry conditions prevailed during the second and third weeks of December, which checked plant growth sufficiently to force a heavy setting of squares, and by the end of the month rain was required to develop the large crop that was being carried. Good rains were experienced then, but "heat waves" and hard beating storms, which set the surface so that the water mostly ran off into the low places, followed in January, and by the end of that month the crop was definitely suffering from water shortage. This condition continued on through February and most of March until broken by a storm which started sufficient growth in any depressions to produce a light top crop. The adverse conditions forced the maturing of the crop, and harvesting was started and completed earlier than in any previous season. A mean yield of 868 lb. of seed cotton over 53 acres was obtained, which was satisfactory under the conditions. The temperature graphs and rainfall are included to illustrate the climatic conditions under which the crop was grown.

RAINFALL AND TEMPERATURE GRAPH - BILOELA.

SEASON 1934-35.



SEASONAL OPERATIONS.

The work at the Station has consisted mostly of a continuation of the investigations described in the Report covering the previous season. The climatic conditions were of such marked contrast to those of the 1933-34 season that one would have anticipated rather divergent results. Plants markedly shorter and of less vegetative type than is usual for the Station crop were produced in both seasons, however, and a certain similarity of results was thus obtained in many of the experiments.

PART I.

Analyses of soil samples taken on the 4th February amongst the growing cotton crop did not demonstrate that there were significant differences existing between the initial nitrate determinations in soils 10, 6, and 3 years in cultivation out of the virgin condition. Higher readings were obtained in the older cultivations, however, which is in keeping with previous findings. Determinations of the total nitrogen content likewise failed to show significant differences, although the oldest cultivation had the lowest percentage. Soil moisture determinations made fortnightly through the season indicated the oldest cultivation to be less permeable, the moisture content of the oven-dried soils being lower all the season at both the 4-6 and 10-12 inch levels, significant differences being obtained through the first half of the season.

Latin Squares of the same five varieties as were reported upon last season were again grown on the same sites in the three ages of cultivation. Although planted within four hours of each other, the seed germinated more quickly in the newer cultivations than in the oldest one—the more compact condition of the latter possibly having affected the process. Plant growth was more vigorous on the newest cultivation during the first half of the season, and flowering was appreciably lighter than on the 6- and 10-year old cultivations during the early stages of the stress conditions at mid-season. Counts of the total number of fruiting nodes per plant during the first part of January indicated that all five varieties had developed more crop possibilities and had more fruiting forms remaining on the 3-year than on the 10-year old cultivation. Similar counts made towards the end of February indicated the continued superiority of fruiting node production on the 3-year old cultivation (except in the two least drought-resisting varieties), but a substantially greater reduction in the number of forms remaining, the plants having produced too heavy a crop for the climatic conditions and consequently reacted more severely than did the lighter producing plants of the older cultivations.

The data obtained at harvesting may be summarized as follows :—The 6-year old cultivation produced the heaviest total yield ; the 10-year old the lowest—the difference of the mean yields of the 5 varieties per cultivation being 58 lb. seed cotton per acre. The mean yield of the 3-year old cultivation was only 17.6 lb. seed cotton per acre higher than that of the 10-year. This would appear to indicate that the slightly higher initial nitrate content that existed in the 6-year old as compared to the 3-year old cultivation, in the mid-seasonal analyses of these soils, was of benefit to the crop, for there was no significant difference in the moisture content of the two soils during the season. The two varieties most suitable for fertile soils under good growing conditions yielded the highest. The latest fruiting variety of the five was last in all three cultivations, the dry second half of the season checking the development of the heavy top crop which this variety usually bears on the upper parts of the vegetative branches.

The data obtained from 50 plants of each variety—10 in each plot—indicated that there were no significant differences in the number of bolls, the motes and seed per lock—although the 3-year cultivation tended to have more of each, mean weight of 4- and 5-locked bolls, percentage of 5-locked bolls, and percentage of bolls on the fruiting branches of the main stalk. Likewise, there were no significant or consistent differences in these characters for any variety on the three ages of cultivation. The mean lint percentages of the five varieties indicated that the 3-year old cultivation produced significantly the highest lint percentage, which also held true for each variety except the most drought-resistant, which showed practically no variation. The mean of the lint indices of the five varieties on the newest cultivation was also significantly higher than were the means of the other two cultivations, with the lint index of each variety tending to be higher, but not always significantly so. No significant differences were observed between the three ages of cultivation regarding the mean grade, length, strength, body, and drag of the fibres of the 5 varieties, although the heaviest bodied variety produced the best fibre on each cultivation and the lint of the rankest growing variety contained the most “ spot.”

Examinations of the ploughed out root systems of 60 plants in each variety per age of cultivation indicated that there was no significant difference between the means of the three ages of cultivation, although the actual data indicated that the plants on the 6-year old cultivation tended to have the best root system for the season. The results of the root investigations are somewhat at variance with those of the previous season, when the plants on the oldest cultivation had

significantly more large laterals, which were of smaller diameter, than did the plants in the newer cultivations. The difference in moisture content of the compact soils of the older cultivation during the latter half of the two seasons may explain the growths; the harder soil restricting root development this season.

Sievings of the soil, similar to those of last season, were made in 3- and 10-year cultivations during the ploughing of the seed bed at the end of the crop, and again 34 days later during which period temperatures as low as 9 degrees of frost were experienced, and a total of 3.64 inches of rain was received. The results obtained at the first sowing indicated that there were no significant differences between the two cultivations except in the class for clods $\frac{3}{4}$ to $1\frac{1}{2}$ inches in size, where the 10-year cultivations had the higher percentage. At the second sieving there was a definite tendency for more large clods to form in the older cultivation at the expense of the smaller particles, although the only significant difference between the two cultivations was in the class ranging from $\frac{1}{8}$ to $\frac{1}{4}$ inches in size. Significant differences were obtained between the two sievings in the older cultivation, however, there being more large clods at the second sieving and decidedly fewer particles finer than $\frac{1}{8}$ of an inch. The results thus verify the observations which have been made, that the soils of the old cultivation set more following good rainfall.

Another supplementary varietal test similar to that of last season (except that three new more drought-resistant varieties of open habit of growth were substituted for the varieties of this type that were used then) was grown on the site of the previous experiment. The results obtained confirmed the findings of the previous season, that the more open types with quicker setting of crop were superior on the old cultivations.

Spacing Tests.—Spacing tests in the Indio-Acala variety, similar to those described in the last Report, were repeated on the same sites. The seasonal conditions levelled up results, so that no significant differences in yields were obtained between treatments on a cultivation in either experiment.

The flower counts in both experiments showed marked superiority in flowering for the unthinned and bunches spaced 1 and 2 ft. apart during the favourable growing conditions of the first half of the season, but a marked reduction was observed as soon as stress conditions were encountered, when the 2 ft. singles went ahead for the rest of the season on the newer cultivation, and for most of it on the older one. Each spacing flowered more heavily for the season on the newer cultivation except the 1 ft. bunches—the total for all treatments being 7% greater than that of the old cultivation.

The actual yields produced indicated that 2 ft. doubles, i.e., 2 plants 2 to 6 inches apart spaced every 2 feet, was the best yielding, followed by 1 ft. singles, on the 3-year old cultivation; while on the 10-year old cultivation, bunches a hoe width, i.e., 7 inches, spaced a foot apart, were the best, followed by 1 ft. singles and 2 ft. doubles. Two foot singles were lowest on the older cultivation, and next to lowest on the newer one, indicating that with the dry conditions in the second half of the season an efficient use of the ground was not obtained with the widely spaced plants on account of their checked development. The 1 ft. singles outyielded the unthinned cotton by 73 and 48 lb. seed cotton per acre respectively in the 3- and 10-year old cultivation, which would give net financial gains, after paying for picking, substantially exceeding the cost of thinning. The mean yield of each experiment, 1,059 as compared to 837 lb. seed cotton, showed a gain of 222 lb. or 26% in favour of the newer cultivation.

Studies of the lint characters indicated that on the newer cultivation the 2 ft. doubles and singles produced fibres of slightly better strength and body than the rest, while the bunches spaced 2 ft. apart produced slightly more spotted fibre. On the older cultivation the fibre of the 1 ft. singles was of slightly superior strength, with all treatments containing about the same amount of spot. The grade of all treatments in both experiments was Strict Middling, Light spotted. Examinations of 50 plants each in the 1 and 2 ft. single spacings indicated that there were neither significant differences between the two spacings in a cultivation in the lint index and ginning percentage, nor between these factors on the two ages of cultivation, although there was a consistent tendency for the 2 ft. single and the newer cultivation to have a slightly higher lint index.

Examinations of the root systems of the 1 and 2 ft. single spaced plants and the 2 ft. doubles showed that stalks were of greater diameter at the cotyledons in the 1 and 2 ft. singles on the old cultivations, but there was no difference in the 2 ft. doubles; there were also more fibrous laterals in the first 4 inches of soil for all three treatments in the older cultivation; the 1 and 2 ft. bunches and unthinned had the fewest large laterals in either cultivation, while the unthinned had more fibrous laterals.

The general results obtained are somewhat in keeping with those of last season, except that the older cultivation then produced the greater number of flowers. The newer cultivation outyielded the older in both seasons, with the 1 ft. singles treatment ahead last season, and second highest in both experiments this season, and no significant differences between any spacings. The dry conditions levelled

the quality and grades of the fibre of the different treatments so that the differences that were obtained last season did not show themselves.

Spacing Tests in Other Varieties.—In order to obtain further evidence of the effect of plant spacings on different ages of cultivations, tests comparing 1 and 2 ft. singles and 2 ft. doubles were carried out in the Cliett variety on 3- and 10-year old cultivations. This variety is of a more open "squatty" type of plant than is Indio-Acala; it flowers earlier and sets a heavy crop well down on the stalk. The order of superiority of flowering was the same on both cultivations, the 2 ft. doubles being ahead and the 2 ft. singles last. The total flowering indicated the newer country again leading by 7%. The sites of the experiments were of slightly sandier soils than were those for the Indio-Acala, so that shedding of the top crop was more severe under the adverse climatic conditions. The 2 ft. doubles outyielded the other two spacings, although not significantly on the 10-year old cultivation, whereas significance ($P=0.1$) was obtained on the 3-year old cultivation. The 1 ft. single was ahead of the 2 ft. single on the older cultivation, but behind on the newer one, the difference not being significant in either case.

The mean yields, 857 and 826 lb. seed cotton per acre, were again in favour of the newer cultivation, although showing only a 3.7% gain instead of the 26% obtained in the Indio-Acala test. Similar soil influences were obtained in comparisons of new and old cultivation effects with co-operators, the gains of different varieties in favour of the new cultivations being less on either the lighter, less fertile, or less moisture-retaining soils.

A similar spacing experiment was conducted in Durango, a tall growing variety somewhat similar to Indio-Acala, except that it produces a heavier crop on the upper branches of the large vegetative branches. The experiment was on the 6-year old cultivation of the same type of soil as that on which the Cliett tests were carried out. The 1 ft. singles produced the most flowers, but the 2 ft. doubles yielded the highest, although not significantly so. The yield of the latter spacing was less than that of the 2 ft. doubles in the Cliett variety on either age of cultivation, the season restricting the usual development of the upper structure of the vegetative branches of Durango.

SUMMARY OF PART I.

The results obtained support the theory which has been formulated, that the cultivation of successive crops of cotton over a series of years on the alluvial loams and clay loams, increases the nitrate content of

these soils to a point at which varieties of cotton of open habit of growth are the most suitable. Owing to the reduction of the carbon content which accompanies the increase of nitrates, the older cultivations tend to set more and more with each season's cultivation to cotton. They thus become less permeable to beating storms, which renders it necessary for a variety to have drought-resistant properties as well as an open habit of growth. During the last two seasons in which corn ear worm attacks have not been experienced there have been indications that an early flowering variety is of advantage. It will be necessary to experience a severe corn ear worm attack, however, before any definite conclusion can be reached as to the merits of such varieties, which mostly have a tendency for somewhat determinate habit of growth. The results obtained from the spacing tests, while somewhat confusing, indicate in a general way that 12-inch spaced single plants are fairly satisfactory on the alluvial soils under a range of conditions. The same conclusion has been deduced from thinning tests conducted with co-operators on similar soils. For less fertile soils 20 to 24 inches appears more satisfactory.

PART II.

Rotations—Cotton following Giant panicum outyielded cotton following cotton by 59 lb. seed cotton per acre. In only three out of nine seasons, however, has cotton following panicum been ahead, and each time prolonged dry periods in the second half of the season were experienced. It would thus appear that the early ploughing that is possible after the quick maturing panicum allows of sufficient storage of subsoil moisture during the autumn and winter rains to be of assistance to the following cotton crop in some dry periods in the latter part of its growth. The mean gain over the nine years of the experiment is only 24 lb. in favour of cotton following panicum, most of which was contributed by one exceptional result. There appears to be a tendency, however, for some gain to be obtained in a season experiencing a dry second half, where cotton follows a fodder crop such as Giant panicum, saccaline, sorghum, Sudan grass and maize, for this season all such plots outyielded corresponding plots in which cotton followed cotton. Maize does not appear to be as beneficial as Giant panicum, the mean gain over the life of the rotations so far being in favour of the latter; cotton following maize following wheat also did not yield as well as cotton following panicum or cotton.

The experiment testing the effect of growing Rhodes grass on the older cultivations for a couple of seasons and then following with cotton was continued—being in the second season following the

ploughing up of the grass. The denitrification effect that was noticeable in the cotton in the first season after the grass was not apparent in this crop. Counts of main stalks with terminal buds made at mid-season indicated a significant difference of 8.2% more terminals in the crop following Rhodes grass on a slight slope of a sandy clay nature, but no significant difference on the fertile alluvial loams, although the data for the former Rhodes grass plots showed 3.2% more terminals. There was no difference in the mean heights of plants in the two treatments, however, on either soil type. The plants indicated a significant gain of 90 lb. seed cotton or 12% in favour of the former grass plots on the fertile loam, but only 19 lb., or 3% gain, on the sandy clay slope. Similar results were obtained in other varieties in comparisons of new and old cultivations of farmers—the more fertile soils yielding greater gains on the new cultivations than did the less fertile slopes. Data from 60 scattered plants in each treatment on the less fertile soils showed no significant differences in the per cent of 5-locked bolls, mean weight of 4- and 5-locked bolls, number of seeds per lock, number of motes per lock, and number of bolls per lb. of seed cotton. The same results were obtained on the more fertile loams. Root measurements of 60 random selected plants in each treatment on each soil type, indicated a tendency for larger rooting systems following the Rhodes grass. Soil sievings at the first ploughing failed to show significant differences between the two treatments in any class. Similar results were obtained four weeks later during which period heavy rains had been experienced. There was a tendency for the largest clods to weather down in both treatments, however, particularly in the former Rhodes grass plots.

The general results obtained so far in the investigations of the effects of rotations would indicate that some gain may be anticipated where cotton follows Rhodes grass in both the first and second year after the ploughing of the grass. Climatic conditions appear to determine the gain that is obtained following ordinary fodder crops like sorghum, panicum, Sudan grass, etc., seasons experiencing dry conditions in the early part of the second half of the cotton crop being favourable to increases, while no gains and even losses may result in wet seasons.

ENTOMOLOGICAL NOTES.

The Station cotton was remarkably free from any serious attacks from insects. Wire-worms were present in large numbers just prior to and at planting time, but the series of rains following planting were apparently of assistance in saving the crop from damage. Cutworms

occurred only to a slight extent, but aphids attacked the seedlings rather severely until thinning time, when the ladybirds controlled the situation. Corn ear worm trouble appeared imminent by mid-December, when counts indicated an average of four eggs per plant on two scattered lots of 25 consecutive plants, but no serious damage resulted. *Earias huegeli* and *Eucosma* were also noticeable in mid-December, but no later attacks occurred.

Angular leaf spot was fairly prevalent on the Station on both leaves and bolls, and it is believed it was responsible for much of the yellow staining of the lint, which was more noticeable than usual both at the Station and in the surrounding district.

SOUTH AFRICA

COTTON EXPERIMENT STATION, BARBERTON.

PROGRESS REPORT FOR THE SEASON 1934-35.

COTTON-BREEDING AND FIELD EXPERIMENTS.

BY

F. R. PARNELL AND W. L. FIELDING.

Season and General.—A rather higher total rainfall was received this year, 25·76 ins. against a mean of 21·46 ins. for the previous four years. The bulk of this fell in the early part of the season, however, and the latter half, from early February, was extremely dry.

Practically all the cotton on the Station was planted from 13th–17th November in good conditions and excellent stands were obtained. The young crop did not get away well, apparently owing to the weather being too wet and cold; early growth was generally poor and the plants were badly infested with aphids. The crop on the light granite soil was the first to get away and this steadily improved and did well. On the heavier red loam marked differences appeared. Certain blocks improved steadily and gave good even growth and excellent results; others remained stunted and never grew healthily, or produced a very uneven and patchy growth. Further reference to this condition is made below.

In the district the area planted showed an increase over the previous season but growth was generally poor, aphids again being very prevalent. There was no opportunity for the crop to recover later in the season as it was too dry. The few showers received by the Station in the middle of March were not general and on most farms no effective rain fell after the first week in February. In the circumstances the yields were poor and the total production of the area was slightly lower than that of the previous season.

Both on the Station and in the district bollworm was much less in evidence than in the previous season and losses on this account were seldom serious. On some parts of the Station an appreciable amount of the early crop was taken by American bollworm, but not enough to spoil any of the experimental work. Jassid and stainers were present only in very small numbers and caused no damage.

Poor Growth and Patchiness.—Areas of poor growth have previously occurred on the Station, generally for some obvious reason, but we have never before experienced the type of patchiness that occurred this season. In several cases fields that are looked upon as very uniform, and that have previously given good even growth with all crops, gave such an uneven growth of cotton that nothing could be done with it. The variation was not gradual, but took the form of irregular patches of bad amongst good, or vice versa, often sharply marked and sometimes only a few yards in width.

A severe wind storm occurred on December 17th and, though the windbreaks saved the crop considerably, some damage was done. The most sheltered blocks were those that gave the best and most even growth later. The more exposed blocks were certainly checked more, but it is difficult to imagine that the damage was so uneven as to give rise to the patchiness under discussion.

Again, aphid was much in evidence for a very long period on the more poorly grown cotton and undoubtedly kept it back badly. It is uncertain whether this was a first cause of poor growth, or whether it was largely a result of poor growth due to some other original cause. It appeared that any patch that was once severely checked never succeeded in getting away from the aphid completely and in this manner there must have been considerable accentuation of early differences. It is possible that the early differences were no greater than usual, but that their extremely marked nature later in the season was due to accentuation by the unusually heavy aphid infestation. If aphid appears in any quantity again, the opportunity will be taken of trying to learn something definite on this point.

Selections.—The selections planted comprised 324 lots, special bulks and single-plant selections, from U.4 and 193 lots of Harland's crosses, all special bulks, with the exception of two families, 920 and 921, where growth was bad, the U.4 selections occupied a block that gave good even growth and thoroughly satisfactory material for making comparisons. The crosses were on a block where growth was generally poor and the material was not so good for selection work.

Excellent progress was made with the majority of the U.4 lots and it was possible to discard with confidence several whole families that had been marked down as doubtful in previous seasons. Good families were likewise ridded of the poorer groups inside them and a general clearance made of much material that would not have survived so long had the previous two or three seasons been more satisfactory. Added confidence in discarding material from the breeding blocks was derived from the fact that judgments made there were in close

agreement with variety trial results in all areas. The better families contained many very good looking lots. Some of these were picked as whole plots and yielded at the rate of about 1,250–1,350 lbs. per acre, a very good yield in so short a season.

Two families referred to above, 920 and 921, were on a separate block where growth was bad and no progress could be made with them. They badly need clearing up as no reliable comparisons have been possible for several seasons. All their strains are in the form of small bulks and the seed is sufficient for planting in several places. This will be done in the coming season in an attempt to ensure some efficient work on them.

Harland's crosses occupied a block where growth was mostly poor and the material was unfit for very detailed and close comparisons. It was possible, however, to pick out promising lots and to discard many that were undesirable. The bulk of the material was from the cross (U.4×Cambodia)×U.4 and, as in the previous season, this was far better than that from other crosses. The latter were discarded entirely as they showed no likelihood of being useful economically. About one third of the former group, 62 lots, were selected for carrying forward, all in the form of small bulks. Most of the lots discarded were either very late, poor fruited, or bad shedders. Many of the good lots behaved very well in the poor conditions and, judging from those on one side of the block where growth was better, they show excellent promise.

Variety Trials.—Five separate Variety Trials were planted on the Station and two on neighbouring farms. The latter had to be abandoned, in one case early in the season after a very heavy storm and bad wash, in the other owing to irregular growth that became much accentuated later in the season when the crop was droughted. Two of the trials on the Station were fairly satisfactory, giving good growth that was reasonably uniform ; the others were not so good owing to poor growth or patchiness.

One of the good trials comprised a number of miscellaneous strains that were being given a last chance before being discarded. All of them gave only about the same yield as Bulk, and the same results were obtained at Magut. In view of the much better results from other strains with a better previous record, they have been discarded. They represent some of the families referred to above as having being discarded from the breeding block and include 9158, 9243, 9292 and 9340.

The other good trial included the early strains, all being derivatives of U.4/4. Our endeavour with these strains has been

to combine sufficient strength with very heavy fruiting, either by increasing the strength of U.4/4/2 types, our small but exceedingly heavy fruiter, or by getting more regularly heavy fruiting into the normal U.4/4 type. Some measure of success has been obtained in both directions as indicated by the figures given in the following table.

IMPROVEMENT OF EARLY STRAINS.

<i>Origin.</i>						<i>Strain No.</i>	<i>Yield of Lint in lbs. per acre.</i>
U.4/4.	From original Special Bulk	...	...	...	...	4/4	265
do.	Selected for Fruiting	...	...	...	...	052	338
U.4/4/2.	Typical Strain	...	...	...	...	955R	265
do.	Selected for Strength	...	...	...	...	951R	316
U.4	From original Special Bulk	...	...	...	...	U.4 Bulk	233
	Difference required for P=-05	...	...	...	...	—	75.6

Unfortunately the experimental error is high, but the results, nevertheless, are most encouraging, particularly the excellent yield of 052. Further reference will be made to this strain later.

Results from the three poorer trials were too irregular to give much reliable information. Strains from the old Z.14 group, 9355 and its derivatives, were definitely poor and have been discarded, as this agrees with much previous evidence in various places. There is good material, as compared with Bulk, in the 920, 921 and 9264 groups, but more reliable figures are required before attempting to judge between the different strains in these groups. Unfortunately the direct comparison between these types and 052 was not reliable since the main trial in which it occurred, though allowing for 12 repetitions, was too irregular.

It has been usual to give 12 repetitions in the main trial and 6 in subsidiary trials, all with four-row plots. In future all trials will be given 12 repetitions and, except in the main trial, two-row plots will be used to reduce the size of the blocks. In the main trial, where there are appreciable differences in size and habit between the strains, two-row plots are less suitable. A still further reduction in the size of the blocks will be effected by reducing the number of strains in a trial as far as can be done.

Some interesting results, which are worth reporting, were obtained from flower counts taken on two of the variety trials. When the drought was being felt severely, at the end of February and in the first half of March, flowering fell off generally, but much less markedly in some strains than others. As might be expected, the strains that had been slow in starting generally fell off less than early types with more to their credit already. There was more in it than this, however, and certain strains definitely showed greater drought resistance

than others, judged by their ability to keep up their flowering. The flowering curves given in Fig. 1, for two good and two bad strains in the main Variety Trial, show the differences very clearly. It should be noted that the large sudden drop for the week, March 16th-23rd, was after rain and due to the sudden change. The best strains from this point of view were 052, 9264, 921 and its derivative 0101. In

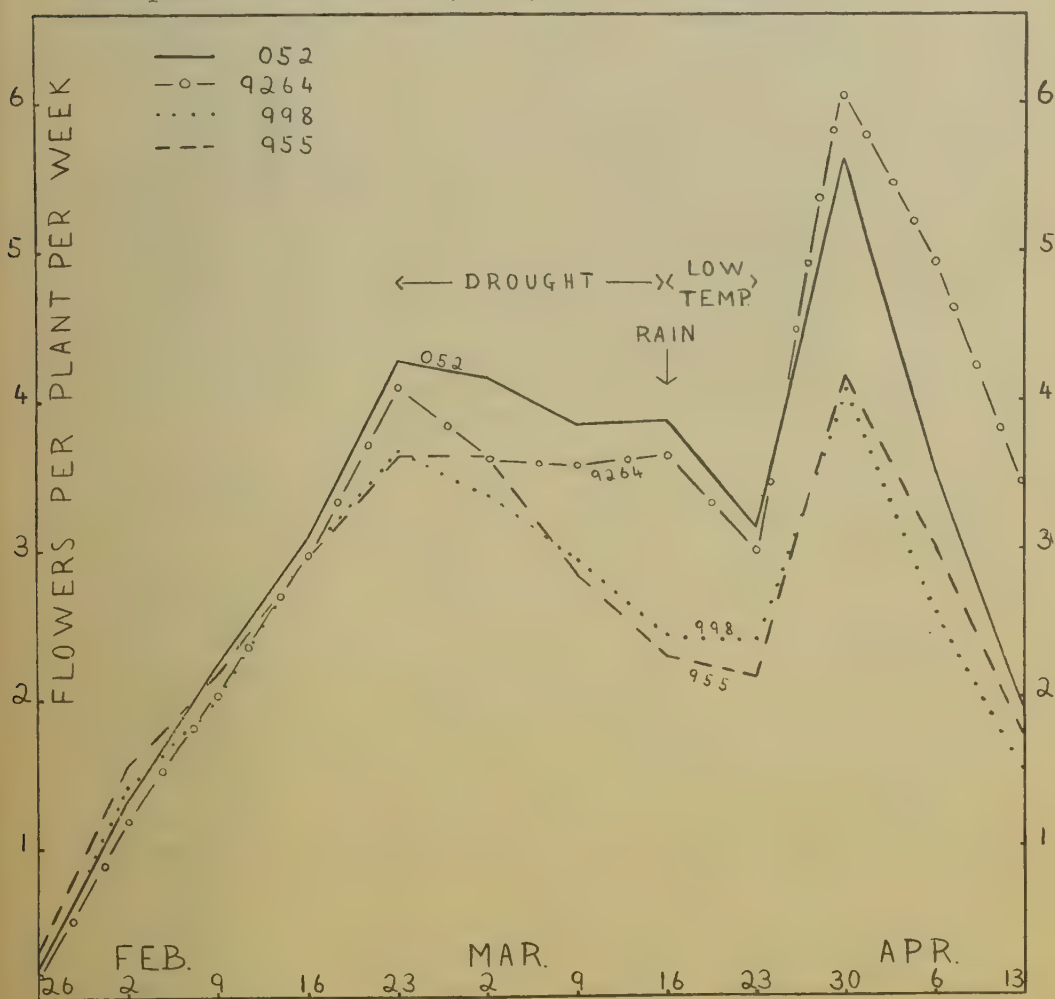


FIG. I. FLOWERING CURVES OF FOUR STRAINS.

Note that 052 and 9264 maintained flowering far better than others during drought, February 23rd—March 16th.

the variety trial of early strains 052 behaved in exactly the same manner, maintaining its flowering far better than all the others of this group. A special point in its favour is that in both trials it was already well ahead in its flowering and might have been expected to feel the drought more than other strains.

Multiplication and Distribution.—Since U.4 was first grown in the area there has been no general distribution, until this year, of any improved strain derived from it. Several good ones, definitely better than the ordinary Bulk, had been grown on a field scale by selected farmers, as a tentative measure, but none has been so convincingly superior as to warrant its general distribution. We now have in 052 a thoroughly good strain of a type that appears to be the most suitable for general cultivation, *viz.*, a heavy fruiting early type with plenty of strength.

A provisional multiplication of 052 was carried out this season with the help of several farmers who very kindly put in hand-planted plots of a few acres each. Over 4 tons of seed were obtained from 55 lbs. planted in this way and a further half ton was grown on the Station. In view of the excellent results given by 052 again this season, the above seed has been distributed to a number of growers for large scale multiplication in the coming season. An additional 9 tons of seed, derived from earlier variety trial plots of this strain, have also been distributed, but this will not be used again for seed purposes.

MISCELLANEOUS.

Fertilizer Experiment.—On the loam soil the old fertilizer experiment was continued, with the same treatments as described last year. The cotton was poorly grown and yields were small, but definite results were obtained confirming those of previous seasons. Potash and Phosphate separately gave significant increases, the former being actually the higher for the first time, but with little difference between them. The K.P.N. treatment very definitely headed the list, however, and was significantly higher than all the others.

On the granite soil a preliminary examination was conducted with Potash, Phosphate and Nitrogen applied separately, and nil. The yield from the Nitrogen treatment was significantly greater than all the others and gave an increase of about 60 per cent. over nil. Phosphate gave a significant increase over nil, but Potash, though not greatly lower, just failed in significance. The effect of nitrate on this soil, a light and gravelly type very common in the area, was very evident to the eye throughout the season.

Maize-Cotton Rotation and Phosphate.—This experiment was continued as described in the report for 1932-33. With both maize and cotton the direct application of Phosphate gave substantial and significant increases in yield over nil. In both cases the residual effect, from Phosphate applied to the alternate crop in the previous season, gave rather lower increases that just failed to be significant.

Spacing Experiment.—The usual spacing experiment was planted, but growth was very poor and uneven and no significant results were obtained.

PLANT PHYSIOLOGICAL WORK.

BY

O. V. S. HEATH.

The main work of the season was again devoted to the Rotation Experiments and Cultivation Experiment. Plant sampling and growth observations were carried out on these experiments as in the previous season. Yield figures were also obtained, although a great deal of irregularity and poor growth, which may have been due to aphid attack, appeared on the loam soil after the early part of the season. Two-daily measurements of height of main stem, for correlation with meteorological data, were again carried out, but were not very satisfactory owing to the above-mentioned irregularity of the plants.

ROTATION EXPERIMENTS.

The layout of these experiments was described in the Report for 1932-33 (pp. 79-80). There are two experiments, one on the loam and the other on the granite soil, each consisting of two "sub-experiments." In any given season one of these sub-experiments has the six rotation crop treatments (cotton, sunflowers, maize, soya beans, tepary beans and fallow) and the other is under cotton throughout. In the following season these treatments are reversed, cotton following rotation crops on the one sub-experiment and rotation crops following cotton on the other.

Loam Soil.—"Sub-experiment A."—This was planted throughout with 920 S.B. cotton on November 20th, 1934. Germination was rapid and even, practically full stands being obtained within five days of planting. There was, however, a small but significant effect of treatment on germination, the fallow and sunflower treatments having a 99 per cent. stand on the fifth day as compared with 96 per cent. for the cotton and maize. The fallow treatment also showed an initial advantage in size of the seedling (as in the previous season), the total dry weight ten days after germination being significantly higher than on any other treatment. Eighteen days after germination the fallow had lost this lead, the seedlings now having a significantly lower total dry weight than on any other treatment. Thus the usual depressing effect had overcome the initial advantage of fallow, just as in the previous season. The total dry weight for the fallow treatment

continued lowest up to thinning date (January 3rd, 1935, when sampling had to be discontinued) while maize and soya were also poor, and cotton and sunflower were highest. Later in the season the fallow again went ahead and, unlike the previous season, there was no significant difference between treatments in time of first flower opening.

In last year's Report it was suggested that the poor growth on fallowed land might be due to lack of aeration of the soil below about 2 feet, consequent on the continuously high moisture content at and below that level. Soil moisture determinations on sub-experiment A at the beginning of this season (November 29th, 1934) and on sub-experiment B at the end of the season (July 1935, see below) confirm that the moisture content of the fallowed soil at and below 2 feet depth does not fall much lower than 18%. On the other hand, examination of root systems during January, 1935, failed to produce any very conclusive evidence of damage to the tap roots on the fallow plots. It is hoped to repeat the root examinations during the coming season at an earlier stage in the plant's development.

Pickings were carried out at seven fortnightly intervals from April 30th, to July 23rd, 1935. The first picking showed fallow (90 lbs. seed cotton per acre) lowest, and tepary (127 lbs.) and sunflower (126 lbs.) highest. By the second picking a change over in the order was taking place and there was no significant effect of treatment. The third and later pickings showed fallow highest, with tepary second until the 6th picking, and soya lowest until the 5th picking. The separate pickings show the following significant differences between treatments :—

- 1st. Tepary, Sunflower, Cotton (and ? Maize) > Fallow.
Tepary and Sunflower > Soya.
- 2nd. No significance (Order : Tepary, Fallow, Cotton, Maize, Sunflower, Soya).
- 3rd. Fallow > Cotton, Sunflower, Maize and Soya.
(? Tepary > Soya).
- 4th. Fallow > (? Tepary), Sunflower, Cotton, Maize and Soya.
- 5th. No significance (Order : Fallow, Tepary, Sunflower, Maize, Cotton, Soya).
- 6th. Fallow > Tepary, Soya, Maize, Sunflower and Cotton.
- 7th. Fallow > Soya, Tepary, Maize, Cotton and Sunflower.
Soya > Sunflower.

In general it may be said that the tepary treatment was fairly good throughout, especially in the early pickings, and that soya was generally bad. Fallow was good, except in the early pickings, its greater reserves of soil moisture doubtless being unusually advantageous owing to the very dry finish to the season. The long continued picking

season, resulting from the almost complete absence of stainers, also favoured fallow and the total yields showed fallow (856 lbs. seed cotton per acre) significantly higher than any other treatment except tepary (739 lbs.). The lowest yield was soya (602 lbs.), but the differences between tepary, sunflower, cotton, maize and soya were not significant.

A stand count carried out at the end of the season showed soya (90%) with a significantly worse stand than any other treatment (mean of other 5 treatments, 94%), indicating a greater mortality on the soya treatment.

Loam Soil.—"Sub-experiment B".—This sub-experiment was under the six rotation crop treatments for 1934–35. All the crops made excellent growth except the cotton. This was heavily attacked by aphids and was very small, yielding only 273 lbs. seed cotton per acre.

In the winter (July, 1935) after the removal of the crops, samples were taken for soil moisture determination. These were taken at one foot intervals down to five feet depth, at three positions on each of the six plots of four blocks. The averages of all five depths showed fallow (18.5%) significantly more moist than cotton (16.9%), maize (16.7%) and tepary (15.8%), which in turn were significantly more moist than sunflower and soya (14.0%). The individual depths show the following significant differences between treatments (interaction treatment v. depth being highly significant):—

- 1ft. Fallow (15%) > Maize, Cotton, Tepary, Sunflower and Soya (11%).
Maize > Sunflower and Soya.
Cotton and Tepary > Soya.
- 2ft. Fallow (18%) > Cotton, Maize and Tepary > Sunflower and Soya.
(13%).
Cotton > Tepary.
- 3ft. Fallow (19%) and Maize > Tepary > Soya and Sunflower (14%).
(? Fallow > Cotton).
(? Cotton > Tepary).
- 4ft. Fallow (20%) > Maize and Tepary > Soya and Sunflower (15%).
(Fallow and Cotton not significantly different).
- 5ft. Fallow (20%) > (? Maize) and Tepary > Sunflower (16%).
Cotton and Maize > Soya and Sunflower.
(Fallow and Cotton not significantly different.)

These results again show the severe drying effect of sunflowers and soya beans. The drying effect of the cotton would have been much greater for a normally developed crop, as was shown by last season's results.

Granite Soil.—"Sub-experiment A".—This was planted throughout with 920 S.B. cotton on November 14th, 1934. Good germination took place, nearly full stands (92%) showing by the sixth day

after planting. The stand on the tenth day was 95%, there being no significant difference between the treatments on either occasion. Plant sampling showed no significant effects of treatment on the total dry weight, and there was no difference in date of first flower opening. The crop was well developed and pickings were carried out at six fortnightly intervals from April 12th to June 21st, 1935. There was no significant effect of treatment, either as an average effect over all occasions (total yield) or as interaction with picking date (earliness differences). The average yield over the whole experiment was 877 lbs. seed cotton per acre.

Granite Soil.—"Sub-experiment B".—This sub-experiment was under the six rotation crop treatments for 1934-35. All the crops made good growth and the cotton plots yielded 561 lbs. seed cotton per acre.

CULTIVATION EXPERIMENT.

The design of the Cultivation Experiment for 1934-35 was similar to that for the previous season and the treatments (giving hard, normal and soft seed beds) were effected in the same manner. The whole experiment was planted with 920 S.B. cotton on November 28th, 1934 and excellent germination gave a 98% stand within six days of planting, there being no significant difference between treatments. Plant sampling showed that the early growth was significantly more rapid on the compressed than on the normal and grubbed treatments. Pickings were carried out at fortnightly intervals beginning April 26th, 1935. Owing to the great irregularity which had developed by this time (possibly owing to aphids, as mentioned above) they were not very satisfactory, but the first picking showed grubbed significantly lower than either of the other treatments.

A paper is being prepared dealing with the results of the Cultivation Experiments for the last three seasons.

ROTATION CROPS.

BY

M. F. ROSE.

Save for a bad spell of drought in late February and early March, which adversely affected the soya spacing and late-planted maize trials, the season was excellent in every respect and record yields were returned. Locust depredations on the early-planted maize trials were light and recovery was rapid with the ensuing equitable season.

Maize.—The three variety trials on loam soil were planted on November 20th, December 11th and January 7th. Ideal conditions prevailed throughout the growth of the first two plantings, but the dry spell in February-March occurred at a critical stage in the history of the later trial. The inter-row spacing was constant for all strains at 36 inches. The final yields per acre are shown in Table I.

TABLE I.
Maize Variety Trials, Loam Soil, Three Planting Dates.

Strain.	Yield (Lbs. per acre).		
	Nov. 20th.	Dec. 11th.	Jan. 7th.
Hickory (18")	3,679	3,453	1,330
Hickory (24")	3,198	2,891	1,178
White Flint (18")	3,530	3,634	1,937
White Flint (24")	3,124	3,222	1,430
Anveld (18")	3,434	3,536	1,732
Anveld (24")	2,924	2,891	1,373
Peruvian (12")	3,172	3,369	2,384
Peruvian (18")	2,707	2,945	2,008
Potchefstroom Pearl (18")	3,644	2,892	731
Potchefstroom Pearl (24")	3,192	2,622	1,007
Difference required in lbs. per acre for P=·05 ...	255 lbs.	214 lbs.	232 lbs.

Concurrent with the loam trials, similar trials were laid down on the granite soil with planting dates on December 12th and January 3rd. Hickory (18 inches) yielded at the rate of 2,125 lbs. per acre, followed by Anveld (18 inches) 1,977 lbs. per acre and Peruvian (12 inches) at 1,899 lbs. per acre. Potchefstroom Pearl was disappointing with a mean yield for its two inter-plant spacings of 1,602 lbs. per acre.

The January 3rd planting again revealed the potentialities of Peruvian as a late cropper and drought resister. Peruvian (18 inches) and (12 inches) yielded at the rate of 1,236 and 1,136 lbs. per acre respectively, whereas the average yield of the two inter-plant spacings of Potchefstroom Pearl was 475 lbs.

The points of interest in the results are :—

1. The marked superiority of the 18 inch inter-plant spacing over the 24 inch for the conditions ruling during the season.
2. The adaptability of Peruvian to late planting and drought conditions.
3. The fact that Potchefstroom Pearl, a long term variety, which has previously done badly in poorer conditions, has not outyielded the more generally useful strains even with early planting and excellent conditions. It is not so good with medium and later planting and is particularly susceptible to streak disease: it will therefore be discarded finally.

The figures from the bulk fields were as follows :—

1. Flint (early planted, November 23rd) 2,530 lbs. per acre off an area of 7 acres.
2. Flint (mid-season planted, December 12th) 2,613 lbs. per acre off 7·1 acres.
3. Hickory (early-planted, November 24th and mid-season planted, December 12th) 2,737 lbs. per acre off 4·4 acres.

4. Peruvian (late-planted, January 11th) 1,581 lbs. per acre off 2 acres.
5. Peruvian versus Flint—adjacent fields late-planted, January 16th :
Peruvian 1,478 and Flint 582 lbs. per acre.

Streak infection was not in evidence until late January and then only a very mild attack was witnessed as compared with the previous season. Streak counts on the later trials confirmed previous years' figures, Peruvian being very resistant, Hickory resistant, Flint and Anveld susceptible and Potchefstroom Pearl very susceptible. The single-plant selections taken from good and bad lots in the late-planted Flint last year were planted in progeny rows and yielded interesting information on susceptibility and resistance. The data seemed to warrant a more extensive programme and 1,200 plants of Hickory, Anveld, Flint and Peruvian were sowed in the late-planted maize. 400 lots are now on hand for planting, together with direct and reciprocal crosses of Peruvian on Hickory, Anveld and Flint.

The response of maize to heavy dressings of phosphate (750 lbs. of superphosphate per acre) was again very marked, the phosphate plots yielding at the rate of 2,346 lbs. per acre with the nil plots at 1,444 lbs. per acre.

Tepary Bean (Phaseolus acutifolius).—The two-dimensional spacing trials were laid down for the third consecutive year on both the loam and granite soils (January 3rd and 2nd respectively). The yield figures were of a very high order and clearly demonstrate that close spacing does not tend to reduce the vigour and consequent yielding ability of the plant. The wider spacings of the trial, however, mean an appreciable financial loss to the farmer. These results fall closely in line with those previously obtained.

TABLE II.
Tepary Spacing Trial.

Spacing	Yield (lbs per acre)		Loam-Granite Average for 1933, '34 & '35
	Loam	Granite	
12" × 6"	1,565	1,094	1,146
12" × 12"	1,702	1,067	1,088
24" × 6"	1,637	929	1,013
36" × 4"	1,561	818	961
24" × 12"	1,451	758	884
36" × 6"	1,420	755	876
Difference required for P=·05 ...	85 lbs.	109 lbs.	—

Sufficient data have now been accumulated to warrant the discontinuance of these trials.

The results, however, do not solve the problem of the practicability of these close spacings. As mentioned in the last report, multi-coultered drills are not used by farmers in the district and any inter-row cultivation is impossible. An experiment is planned for the coming season with treatments "Broadcast" versus "Drilled." Broadcasting

will obviate the question of drills and with the fairly dense cover of the intended spacing, about 8-9 inches apart, weed growth will be suppressed in the early stages. The drilled seed will be at the usual bulk spacing of 2 feet 8 inches $\times$ 2 inches, a spacing which under the conditions of the past season gave yields of from 1,400-1,500 lbs. per acre.

Soya Bean (Glycine max.).—For the third consecutive season the two-dimensional soya trials, with spacings similar to those of the tepary trials, were laid down on both the loam and the granite soils. The planting dates were 13th and 14th December respectively. Ideal conditions prevailed throughout the growth of the crop, save for the drought spell in late February and early March when the beans were filling their pods. Good yields were obtained on the loam (1,510 lbs. per acre for the 24 inches $\times$ 12 inches spacing) but the granite trial proved disappointing.

The results over the three years have proved irregular. One point of significance, however, emerges from the data obtained: 12 inches $\times$ 6 inches spacing is definitely too close for Yellow 1, whereas the five wider spacings show no definite tendency (*inter se*) of yield advantage. From yield figures obtained from bulk fields it would appear that the most satisfactory spacing, both for growth and subsequent cultivation, is 2 feet 8 inches inter-row and 4 inches inter-plant. Such figures have always compared favourably with the highest yield in each individual trial.

The season 1934-35 marks the end of all soya bean spacing trials and bulk soya bean cultivation on the Station. The reasons for discontinuing the crop are:—

1. Its excessive drain on soil moisture. (See Plant Physiology Section).

2. Its liability to attack by white ants as soon as succulence is lost.

3. Its inability to give a good stand unless planted under the optimum conditions of soil moisture, tilth, etc.

4. A "chancy" crop on the internal market.

Yellow 1 has been used for all spacing trials over the past three years, also for all bulk plantings. Nine special bulk lots from Yellow 1 and Mammoth will still, however, be carried on in small observation plots.

Sunflowers.—St.3 and B.4, with selections from them, have been retained as primary strains at the Station. All types of Russian sunflower introduced in 1932 have been discarded after a three years' trial. Even the most promising lots remained dwarf and mainly ornamental with a very low ratio of fertile to total head.

The special bulk selections from St.3 have proved very uniform, yielding a good concave head which ripens off evenly with very little shattering. Such a type during the past season yielded its crop in one picking as against two in the parent strain.

The programme of "selfing" has been continued, the "selfs" being taken from St.3, B.4 and their respective sub-strains. The percentage recovery has, however, been very low.

INSECT PEST WORK.

1. INVESTIGATIONS ON THE AMERICAN AND RED BOLLWORMS.

BY

F. S. PARSONS.

Bollworm infestations in the Barberton, Magut-Pongola and Swaziland Areas were recorded in continuation of previous pest survey work.

Improvements in technique were introduced notably in methods of sampling insect populations in the field. This formed the subject of an investigation by Mr. Marshall with the result that a satisfactory method has been established, based on a commercial wheat sampling system procured by the present writer from Mr. Yates at the Rothamsted Experimental Station.*

AMERICAN BOLLWORM.

Information Obtained from the Survey.—During the year a moderately satisfactory system was instituted for summarising the information from the first three years' records. This will no doubt require revision as the work proceeds, but it possesses the merit, meanwhile, of preventing the data from becoming unwieldy. As a result, estimations and comparisons of the incidence of bollworm, district-wide and on individual farms, are possible. Using figures on eggs-per-acre and eggs-per-crop-area bases, the source and sequence of the bollworm generations are becoming manifest and, correspondingly, points for the application of evasion or control measures more clearly defined, *e.g.*, the best use, in the summer rotation, of crops more attractive to the moth than cotton, trapping and poisoning of the first summer generation, as remarked upon later in these notes.

* Forthcoming paper in *Annals of Applied Biology* on Methods of Sampling Insect Populations.

The important questions (vide Progress Reports from Experiment Stations, 1933-34, p. 22) as to whether movements of moths occur from one district to another or, to any extent, within districts, have received further attention. In this connection the survey in the Barberton area has been extended to include a citrus and market garden region 30-40 miles distant, where a somewhat different climate prevails and where winter bollworm is paramount. It is of earlier incidence than at Barberton, and chronological differences in the course of the infestations in both areas, viewed in conjunction with extended pupation studies, have, for the present, provided presumptive evidence against considerable moth movement between them.

Some confirmation has been secured of the belief that the degrees of summer infestations on any individual farm are, as a rule, governed very largely by existing opportunities for winter-spring breeding on that farm itself, whether in irrigated crops, natural food plants (weeds) or ratooned cotton. Although in some instances evidence has been obtained suggesting the passage of moths, over some miles, from a solely winter crop farm to rain-grown crops elsewhere, in other, more definite, cases there was no evidence of moth movement even between contiguous farms, as exemplified by egg counts embracing all crop situations and aggregations of natural food plants. The more notable examples of this are observed where irrigable farms intensively planted to winter and rain crops march with farms producing rain crops only. It is to be understood that the crops on two such farms are separated by woodland, grass veld and other features. The bollworm arising from the winter-spring generations on the irrigable farm is apparently confined to the succession and medley of food supply immediately available. Thus, on present information, it is thought that measures taken against bollworm on one farm will not be nullified by circumstances on other farms.

It has been supposed that the American bollworm is numerically greatest in the summer season. On a comparative basis of numbers per crop-area, however, the infestations of the past two years on winter-spring crops in the Barberton and Magut-Pongola areas have many times exceeded the summer infestations. If a satisfactory method of computing bollworm on citrus had been devised to enable their addition, the totals would greatly surpass even the "epidemic" numbers experienced in the summer crops of the 1933-1934 season. Whether it is the case habitually that the main period of bollworm activity falls in the time of the year indicated, *where irrigated crops are available*, remains to be ascertained in future records, as in the 1933-1934 season mid-season drought was a limiting factor and in the

past season virus disease, as noted later, reduced summer bollworm to relatively negligible numbers.

There is a period of 8–10 weeks or longer between the cessation of bollworm activity in irrigated crops and the presence in flower of rain-grown crops. By the end of this intervening period the greater number of the moths produced in winter crop lands have emerged; food plants are then scarce and a decline in bollworm numbers ensues, except where irrigation water has been applied to give a start to very early maize, etc. It is clear, however, that the first generation in unirrigated summer crops, rain-grown weeds and grasses is due mainly to the later emergences of moths from winter-spring breeding grounds and the carry-over of long pupation forms from the close of the previous summer.

The remarks above apply particularly to Barberton and Magut. It is surmised, in the absence of other indications, that the early summer bollworm in the dry farming cotton areas of Swaziland is initiated entirely by the carry-over proportion of long pupation forms there.

The presence in abundance of flowering weeds, especially in young crops, generally gives rise to a lengthening of the period of the first summer attack, as moths bred in weed lands may, with moths from other sources, produce an immediate second, but generally smaller, brood on early rain crops. Another similar and important source is ratooned cotton. Figure II, constructed from moth emergence data, illustrates the occurrence of this second portion of the first main brood. Moths from ratoon cotton lands were responsible for the February infestation shown in the graph. Where there was no ratoon cotton there was, as usual, little bollworm activity between the first and second generations, which in this case appeared in January and March. The failure of the second and third generations is attributed to the virus disease referred to elsewhere in this Report.

Tobacco contributes, with natural food plants and ratooned cotton, to the brood indicated, but to a minor extent only, as larval survival on tobacco is, relatively, exceedingly small, for reasons which need not be entered into here.

As briefly discussed above, on present information, there are two situations to be regarded in the protection of cotton from early summer bollworm, and the use of maize, as follows, constitutes our present means of affording protection.

Early Planted Maize Crops.—The method is to plant an area of maize shortly before or at the same time as cotton, followed at two to three weeks' interval, or as conditions permit, by other plantings; the object is to obtain the presence of considerable bodies of maize

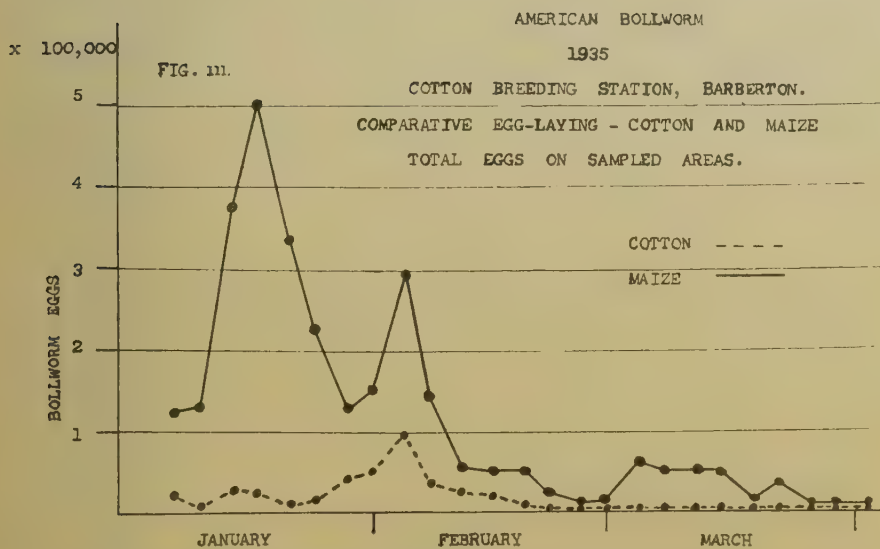
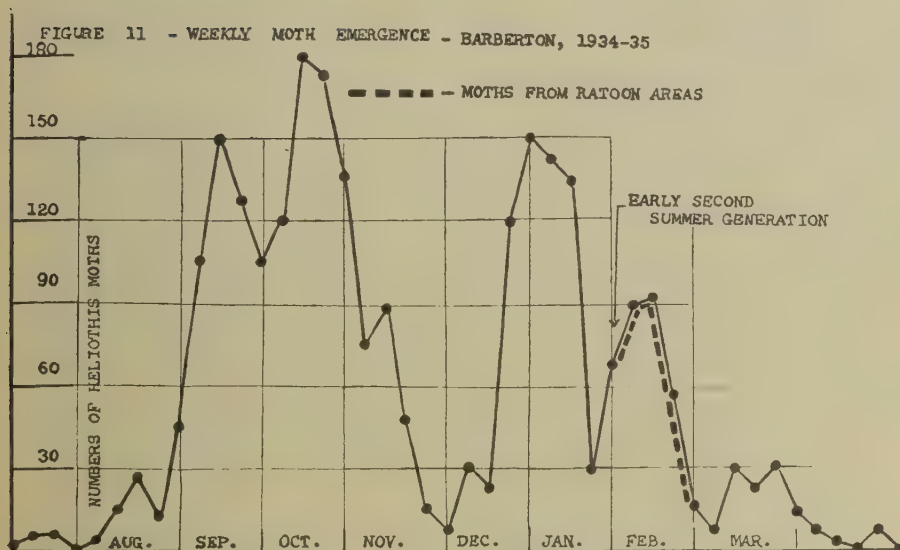


FIG. III. RATIOS OF MAIZE IN TASSEL TO COTTON.

(a) Sampled Fields as above:—Jan. 1 : 3 ; Feb. 2 : 3 ; Mar. 1 : 2..

(b) Over all Fields, Cotton Experiment Station:—Jan. 1 : 4.5 ; Feb. 1 : 3.5 ; Mar. 1 : 5.

in fresh tassel during the flight of moths from previous breeding places, as above. In the past two seasons two closely successive plantings sufficed to span the period of the first generation moth flight, but only where emergence in ratoon cotton lands was not a factor, and the egg-laying of the past season, like that of 1933, was almost entirely confined to the maize crops. The comparative oviposition on cotton and maize at Barberton last season is shown by graphs in Figure III.

In the case of situations embracing ratoon cotton, a third planting of maize, or three plantings within the first 6–8 weeks of the planting season, were required to divert moths of the first main flight to maize. The early maize protected the cotton when carrying the first bolls and flowering most freely.

Late Planting of Maize.—A second and frequently larger generation of bollworm in March and a third, late generation in April-May are to be expected, although for reasons associated with drought, larval disease, etc., they may not occur. On the Cotton Stations maize plantings have been continued sufficiently late in the season to provide the extended attraction, and with good results in most instances. Farmers, however, have not in general planted more than one late maize crop, except for a few inadequate trap rows, and it has been largely a matter of hit or miss, according to planting date, whether this late maize has served a really useful purpose or not in diverting American bollworm. That is to say, the production of tassels may have occurred rather too soon or too late with regard to the emergence of moths from the first or second generations, as the case may have been.

Here, maize crops suitably planted commonly divert bollworm moths from cotton most beneficially. But, apart from climatic risks, the number of successive plantings required, the considerable areas of each, and a need, that grows more apparent, of grouping the plantings for trap purposes, all oppose the full adoption by farmers of this means of partial control. In addition, for unknown reasons, maize in tassel does not *always* attract.

Other Methods.—The value of applying insecticides to the first summer generation, particularly on trap maize, is being investigated. At the same time the substitution for maize of a more attractive crop with a longer flowering period is receiving attention. Several crops are under trial as substitutes, on reports from elsewhere of their special attraction to *Heliothis obsoleta*. The end in view is to employ one of these in conjunction with dusting to destroy bollworm at the known beginning of the summer infestation.

Studies on the Pupation Phase.—This work has been greatly extended in order to provide more exact information on the sequence of generations and the influence of soil moisture and temperature.

Virus Disease.—Throughout the year mortality of larvae ascribed to disease has been pronounced and widespread. On post-mortem examinations, following Glaser and Chapman*, the disease has been diagnosed as the so-called Polyhedral or Wilt disease. The disease was undoubtedly the principal factor in reducing an extremely large bollworm population bred on irrigated crops in October and November, 1934, thus leading to a much lighter first summer generation than anticipated and the practical elimination of late summer generations as Figure III indicates.

The disease is again prevalent, but seemingly less wholesale in effect, amongst the present, October 1935, population.

In agreement with Glaser and Chapman's tentative conclusion the disease is attributed to a virus, as we have transmitted it readily to laboratory-bred larvae through food treated with filtrate from L.5 Pasteur-Chamberland filters. The disease is carried into the pupal state, countless reaction bodies being detected in 90% of pupae from larvae collected in November, 1934.

The presence of the disease has necessitated a revision of the manner of collecting field larvae and the introduction of a rigorous system of sterilisation to prevent contamination of material under observation. This has proved a most difficult task and in consequence work in progress was interrupted and work contemplated postponed.

RED BOLLWORM.

In collaboration with Mr. H. Hutchinson a study has been undertaken in Swaziland of the relationship between the red bollworm and its two principal natural food plants, *Cienfugosia Hildebrandtii* and *Gossypium obtusifolium*†. The sites chosen for the work are remote from cotton-growing lands (where the natural course of breeding has been obscured), and it is hoped that the information derived will be of considerable value with respect to alterations of planting dates possible with the facilities provided by the present and potential extensive irrigation projects in the Pongola-Lebombo areas and other neighbouring tracts. These are areas abounding with the known natural food plants, and red bollworm is likely to prove a determining factor, unless it may be evaded as above. The pest survey work along the

* "The Nature of the Polyhedral Bodies Found in Insects."—R. W. Glaser and J. W. Chapman. (Biol. Bull. (Marine Biol. Lab.)) Woods Hole, Vol. 30, No. 5, May 1916.

† On observations due to Mr. Hutchinson in Swaziland, *Cienfugosia gerrardi* Garcke, may now be added to the above as a food plant of *Diparopsis castanea*.

Pongola River under Mr. Bowmaker's charge has been extended to cover this aspect of the investigations there, especially with reference to the influence of soil moisture and temperature on moth emergence in the dry season. A study of the distribution and ecology of *C. Hildebrandtii* and *G. obtusifolium* forms a part of this survey.

II. INVESTIGATIONS ON COTTON STAINERS AND INTERNAL BOLL DISEASE.

BY

E. O. PEARSON.

During the past winter Mr. Hutchinson and the writer have both been absent on leave ; consequently no work other than that of a routine nature was carried out after April, 1935.

Stainer Records on Sterculia Rogersii N.E.Br.—As a result of the survey work carried out by Mr. Hutchinson in Swaziland during the winter season 1934, coupled with that previously done in the low veld of the Eastern Transvaal, the distribution and abundance of the most important tree host of stainers in these areas, *S. Rogersii*, are known with some accuracy. An attempt was made this season to follow up this knowledge by substituting a more precise method of recording on representative colonies for the somewhat haphazard observations which have been made in earlier years.

In the Barberton area four colonies situated 11, 24, 31 and 42 miles from Barberton, along the road down the De Kaap Valley, were chosen as representing the changing conditions between middle and low veld and from each of these ten trees were selected and numbered. These were visited weekly and counts taken of developing fruit, ripe fruit and the number of adult stainers collected on each tree, with all relevant notes. Another colony situated 52 miles from Barberton, where thirty trees on a mile circuit were marked, was visited at longer intervals. It is hoped to keep these colonies under continual observation over a period of years in order to obtain accurate numerical records of the performance of individual trees.

At three of these colonies the crop set was infested by the moth larva noted in previous years* to such an extent that very little matured and the stainer population was small.

At Colony I, that nearest Barberton, a very large crop was set, of which approximately 12% eventually produced open capsules containing undamaged seed ; even so, the seed crop matured was one

* Bull. Ent. Res. XXV, p. 402. Inaccurately described as the larva of a Cossid moth ; it has now been determined by Mr. W. H. Tams of the British Museum of Nat. History as *Charracoma nigripennis* Hamps. (Noctuidae).

of the heaviest ever known. Fig. IV shows the course of events at this colony. As each of the trees was denuded of its adult stainer population at weekly intervals, the numbers collected represent the weekly repopulation of the trees by fresh arrivals (during November) or by individuals which had changed from V instar nymphs to adults (during December and January) during the previous week. The curve for split undamaged capsules shows the actual numbers counted each week, which represent numbers present the previous week plus numbers splitting during the week minus numbers shedding seed during the week.

It will be seen that migration of *D. nigrofasciatus* and *D. intermedius* took place to the trees in early November, before splitting of the crop commenced. That of *D. intermedius* was prolonged and a large population of F_1 adults was bred up on the trees. The migration of *D. nigrofasciatus* was very much larger than that of *D. intermedius*, but the F_1 adult population, in spite of nymphs being present in at least as great numbers as those of *D. intermedius*, barely equalled the original migrant population and was composed exclusively of newly moulted adults.

It was inferred that in the case of *D. nigrofasciatus* the adults were emigrating from the trees a few hours after the final moult, in spite of an abundance of good seed being present on and below the trees. There was thus a gradual decline in numbers during January, and by February few adults or nymphs could be found, practically no F_2 being produced in situ.

At Colony II the crop set was smaller than at the first colony and more heavily damaged by moth larvae. *D. intermedius* occurred in small numbers only, but there was a large migration of *D. nigrofasciatus* to the trees, again before much splitting of capsules had occurred. Breeding was restricted, but even so the F_1 adult population matured in situ was smaller than would have been expected in view of the numbers of nymphs produced and the same emigration of freshly matured adults as took place in Colony I appeared to occur.

In Swaziland three colonies were kept under observation by Mr. Hutchinson. Weather conditions and distance prevented frequent records being taken on two of these, but at a third, fifteen marked trees were observed weekly. Events here were almost identical with those at Barberton Colony II, except that the crop and the subsequent breeding were heavier.

The result of these detailed observations on *Sterculia Rogersii* has been to throw doubts on the hypothesis that in years of abundant fruiting an F_2 of stainers is matured on the trees during February, the

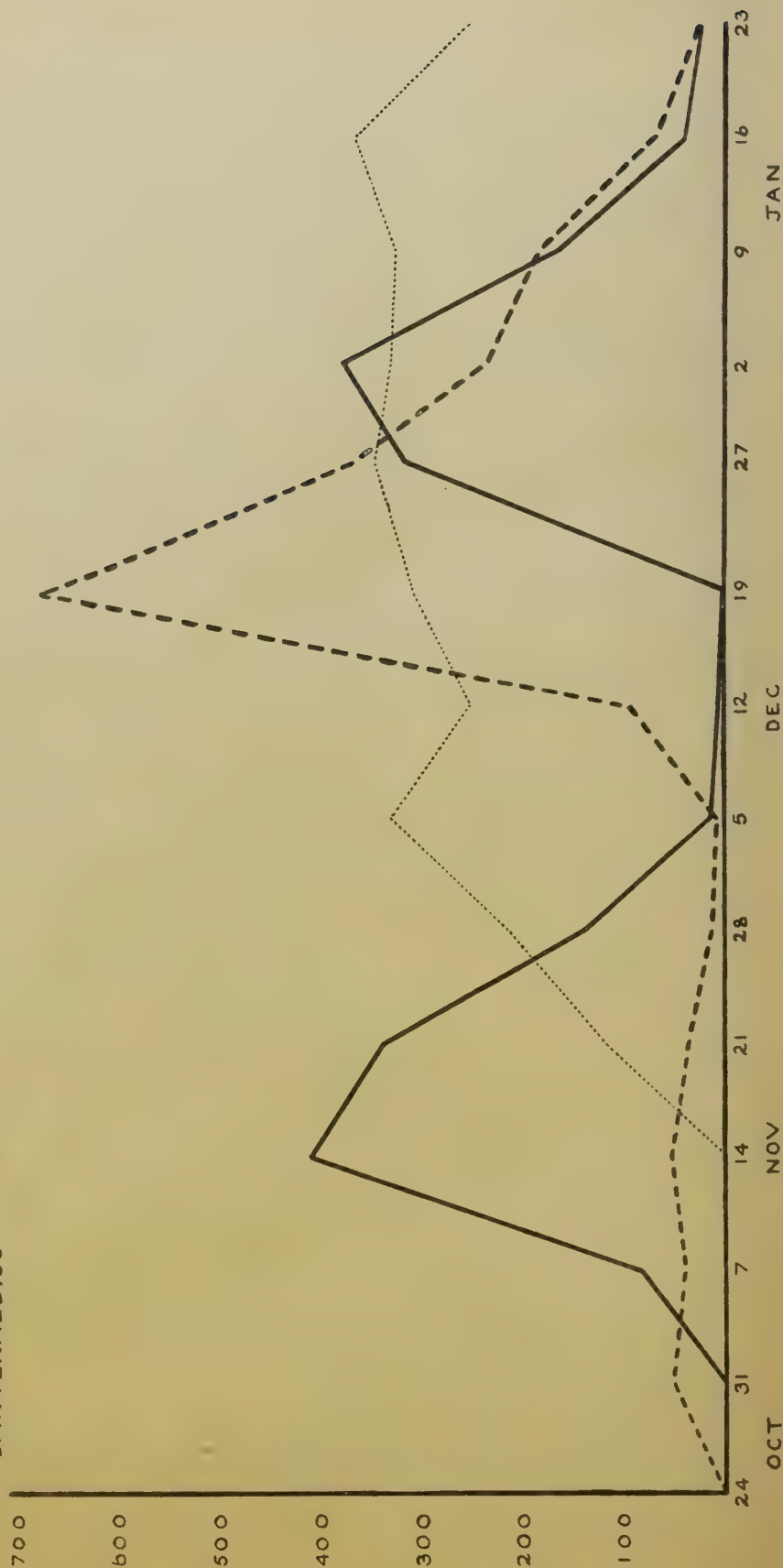
FIG. IV.

STAINER INFESTATION ON STERCULIA ROGERSII, BARBERTON 1934-5

WEEKLY REPOPULATION BY ADULT STAINERS OF TEN TREES

D. NIGROFASCIATUS ———, NUMBERS OF SPLIT UNDAMAGED CAPSULES

D. INTERMEDIUS - - - - -



adults from which constitute the main migration to plant cotton. This season it was clear that F_1 adults left the trees despite an abundance of food supply for them and their potential offspring. A further link between *Sterculia* and plant cotton is thus required.

Observations on Stainers during January and February.—The situation described above has focussed attention on the part played by herbaceous hosts during the early summer. Records from the three previous seasons have shown that during January and February migrant adults, chiefly of *D. nigrofasciatus*, commonly appear in some quantity on those perennial Malvaceae which are then fruiting.

In the present season a careful search was made during mid-January near *Sterculia* Colonies I and II at Barberton. Where clumps of *Hibiscus** bearing green or recently opened capsules were found in the immediate vicinity of the trees they were carrying IV and V instar nymphs and also newly moulted adults of both *D. nigrofasciatus* and *D. intermedius*, the former species greatly predominating. Where these and other plants occurred at greater distances from the trees, only adults, these in large numbers, very active, evidently recently matured and chiefly of *D. nigrofasciatus*, were to be found. During late February a generation of stainers was maturing on these plants. Much the same phenomena were noticed at the Swaziland colonies in late January and early February.

In previous years it has also been noticed that stainers, especially *D. nigrofasciatus*, have appeared from mid-January to mid-February in ratoon cotton, which occupies much the same position, from an ecological point of view, as a perennial Malvaceous shrub. The present year was no exception and ratoon cotton, especially on one farm not far distant from *Sterculia* Colony I, was invaded by large numbers of *D. nigrofasciatus* and smaller numbers of *D. intermedius* during the latter part of January.

It thus seems possible that wild or cultivated perennial Malvaceae may normally constitute the link in time and space between adults maturing on *Sterculia* in January and those flying into plant cotton in late February and early March. Systematic recording will be difficult to apply to these hosts, but an attempt is being made this season to start full investigations.

Stainer Records in the Crop.—Except for slight modifications permitting greater flexibility of application, the method of recording stainer infestations and other relevant data in the crop was substantially the same as in 1934.

The times of fruiting are subject to great variation according to the situation of the particular specimen, but the general order of fruiting of the species concerned is as follows:—*Hibiscus vitifolius*, *H. sp.* near *H. mutatus*, *H. subphysaloides* and *H. calyphyllus*.

Records were taken at eight points in the Barberton district, where allowance had been made for an increase in ratoon cotton by duplicating records on adjacent farms carrying plant and ratoon respectively. In Swaziland records were taken by Mr. Hutchinson at four points, including a low veld area where some extension of native grown cotton may be expected. In Magut records were taken under Mr. Bowmaker's direction at five points, including semi-irrigated cotton on the Pongola and Umkusi as well as rain-grown crops.

D. intermedius was rare except in the field of ratoon near Barberton mentioned above, where a small initial infestation was derived probably direct from *Sterculia* in late January.

D. fasciatus, as in every season since 1932, appeared in small numbers only in plant cotton. A moderate population was built up, however, in one field of ratoon in the Barberton district, where overwintering is believed to have occurred, and there was a small infestation on ratoon on the Cotton Experiment Station in January which was definitely derived from overwintering on small patches of standover cotton on the adjoining farm. The continued failure to find this species in quantity on any wild host plants other than Baobab in the Northern Transvaal, coupled with its almost invariable association with standover or badly ratooned cotton, strengthens the suspicion that the epidemic years of 1931-32 were connected with the presence of abandoned cotton in considerable quantity following the decline of cotton-growing prior to those dates.

D. nigrofasciatus occurred in the smallest numbers ever recorded on non-irrigated plant cotton in all districts, probably on account of the abnormally late boll opening coupled with very dry conditions from February onwards. Staining was correspondingly light. The only exception was one farm in Northern Swaziland where a sudden and heavy infestation of fifth instar nymphs took place following the drying up of *Hibiscus trionum*, which was present in abundance on fallow land immediately adjoining the field where records were taken. Counts of stainers on this land made by Mr. Hutchinson during the early summer clearly demonstrate the movement. In view of the fact that *H. trionum* may be abundant in the abandoned lands common throughout the native areas of N. Swaziland, this relationship will receive fuller investigation.

In semi-irrigated fields in the Magut area the infestations of this species were of a moderate order, with considerable movement of the adults bred in situ as successive fields became attractive. On account of the practice of semi-irrigation the boll-opening was prolonged and staining consequently rather high.

Infestations of *D. nigrofasciatus* in ratoon cotton in the Barberton area, though not serious, were very much higher than those in the plant cotton. On the farm previously mentioned, if not at others, this infestation was probably derived direct from *Sterculia* in January. Considerable breeding took place in these fields, as evidenced by the curve for V instar populations, but the dry conditions from February onwards stimulated an exodus of the adults produced. It is possible that these constituted the small immigration recorded late in the season on plant cotton in the neighbourhood.

Experiments on the Transmission of Internal Boll Disease.—In connection with the records instituted on *Sterculia* trees, samples of stainers collected each week from the trees were tested on sterile cotton bolls. Adults of *D. nigrofasciatus* and *D. intermedius* drawn from both the migrant and F₁ generations on the trees were found to be carrying *Nematospora gossypii*; in all 13% were infected. *Sterculia* fruits examined showed *N. gossypii* present in abundance in the interior of the seed.

It is of some interest that on testing adults of *Odontopus confusus*, a Pyrrhocorrid bug very commonly associated with *S. Rogersii*, they were found to be heavily infected with *N. gossypii*. As this insect passes its whole existence on the tree it may conceivably carry over the infection from one season's fruit to the next.

COTTON EXPERIMENT STATION, BARBERTON, TRANSVAAL.
DAILY RAINFALL, SEASON 1934-35.

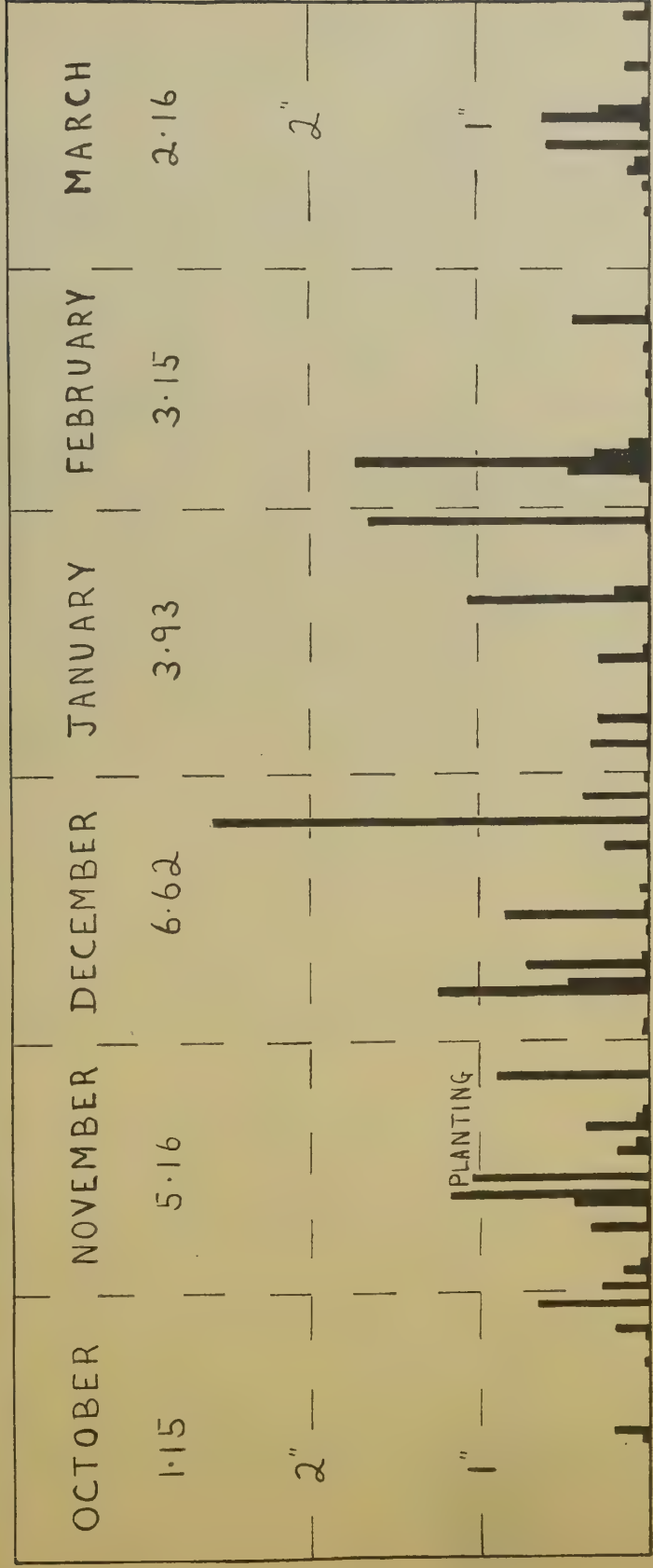
		<i>July</i>	<i>Aug.</i>	<i>Sept.</i>	<i>Oct.</i>	<i>Nov.</i>	<i>Dec.</i>	<i>Jan.</i>	<i>Feb.</i>	<i>Mar.</i>	<i>Apr.</i>	<i>May</i>	<i>June</i>
1	...	—	—	—	—	0.28	0.03	—	—	—	—	0.52	—
2	...	—	—	—	—	0.02	0.02	—	—	—	—	0.02	—
3	...	—	—	—	—	0.15	—	—	—	—	—	—	—
4	...	—	—	—	—	0.05	—	0.35	0.06	—	—	—	—
5	...	—	—	—	—	—	—	—	0.47	—	—	—	—
6	...	—	—	0.13	—	—	1.23	—	1.71	—	—	—	—
7	...	—	—	—	—	—	0.46	0.30	0.31	0.02	—	0.05	—
8	...	—	—	—	—	0.34	0.01	—	0.11	—	—	—	—
9	...	—	—	0.17	—	0.01	0.71	—	—	—	—	—	—
10	...	—	—	—	—	0.01	0.03	—	—	0.04	—	—	—
11	...	—	0.01	—	—	0.44	—	—	—	—	—	—	—
12	...	—	0.06	—	—	1.16	—	—	—	0.12	—	0.25	0.44
13	...	—	—	0.47	—	—	0.01	—	—	0.08	—	—	0.01
14	...	—	—	0.25	0.05	1.05	—	0.30	0.01	—	—	0.17	—
15	...	—	—	—	0.22	—	0.85	0.03	—	0.60	—	0.04	—
16	...	—	—	—	—	—	0.02	—	0.01	—	—	—	—
17	...	—	—	—	—	0.19	—	—	—	0.05	—	—	—
18	...	—	—	—	—	0.08	0.04	—	—	0.62	—	—	—
19	...	—	—	—	—	—	—	0.02	0.29	—	—	—	—
20	...	0.21	—	—	—	0.37	—	—	—	0.03	—	—	—
21	...	0.06	—	—	—	0.07	—	1.06	0.44	—	—	—	—
22	...	0.48	—	—	—	0.04	0.01	0.20	0.01	—	0.08	—	—
23	...	—	—	—	0.03	—	0.25	—	—	—	—	—	—
24	...	—	—	—	—	—	—	—	—	0.14	—	—	0.08
25	...	—	—	—	—	—	—	—	—	—	—	—	—
26	...	—	—	—	0.02	0.90	2.55	—	—	—	—	—	—
27	...	—	—	—	0.18	—	—	—	—	—	—	—	—
28	...	—	—	—	—	—	—	—	—	—	—	—	—
29	...	—	—	—	0.65	—	0.39	0.02	—	—	—	—	—
30	...	—	—	—	—	—	—	1.64	—	0.15	—	—	—
31	...	—	—	—	—	—	0.01	0.03	—	0.02	—	0.01	—
Total	...	0.75	0.07	1.02	1.15	5.16	6.62	3.93	3.15	2.16	0.08	1.06	0.53

Total rainfall for year, 25.68 inches.

BARBERTON

DAILY RAINFALL

SEASON 1934-35



COTTON EXPERIMENT STATION, MAGUT, NATAL. PROGRESS REPORT FOR THE SEASON 1934-1935.

BY

P. A. BOWMAKER.

SEASON AND GENERAL.

The season under review may be considered very satisfactory as a demonstration of the superiority of cotton over all other crops for a dry season in the Magut area. Reference to the rainfall chart will show that planting rains were very late in arrival, planting generally being about a month later than has previously been attempted in the last eight seasons. Including rains a week previous to planting, a total of 8.83 inches of rain was registered to picking time, of which at least 2 inches might be called ineffective. In previous years long spells of very hot weather have been experienced between rains, whereas in the season 1934-35 this was not the case to the same degree, and it is considered that the relatively satisfactory cotton yields obtained are due in some respect to this.

Yields on the Station averaged 520 lbs. of seed-cotton to the acre. Most experiments were carried out on rather shallow land, and show low yields, the average being brought up by seed multiplication yields. In the district, under irrigation, yields of over 1,000 lbs. per acre were obtained, in spite of a heavy January attack of American bollworm; in certain cases of rain-grown cotton yields were poor on account of bad stands, due to attempts to plant on the insufficient rains of November.

COTTON.

Variety Trials.—Trials almost precisely similar to those of the previous season were completed. Planting was carried out from 19th to 23rd December, between which dates all cotton planting on the Station was effected. As would be expected the only test which showed significant differences in yields was that dealing with early strains. Very nice styles of plant resulted from the weather conditions, however, and observations on habit have been very useful in judging between strains.

Five trials were carried out, with from nine to twelve strains and eight repetitions to each, the randomized block system being used. Tables of yields are omitted, but it may be mentioned that the best yields, in the "earlies" test, were taken from strains 929 and 998,

with 195 lbs. lint per acre, compared with U.4 Bulk giving 145 lbs. lint, the difference required for significance ($P=0.05$) being 17 lbs.

Although the yields from the early varieties were better than those from the lates and mediums, which indeed has been the case for the last two seasons, it is felt that the position might easily be reversed should seasons with slightly heavier rainfall occur, which is to be expected. Caution is therefore necessary in forming a final judgment between these types. Results have been sent, as before, for consideration by Mr. Parnell and the Cotton Breeding Section at Barberton, where the discarding of strains is based on the more general experience of their behaviour under varying conditions.

Crosses from Trinidad.—Larger plots were possible with these strains than in the previous season. A number of the strains have been discarded owing to the non-resistance to jassid. The susceptibility of some was a remarkable demonstration of the high standard of the pure U.4 strains from the point of view of jassid resistance. A number of others have been discarded for short lint and undesirable plant habit.

As has been the experience with these strains elsewhere, the best group was (U.4 $\times$ Cambodia) $\times$ U.4. Most of these are being kept on, large special bulks having been taken for seed purposes.

Seed Multiplication.—Satisfactory multiplication of seed of all strains under test was made. As in previous years, for cotton cultivation trials seed of the more promising strains was used, a larger seed multiplication being effected than with other strains, where half-acre blocks are used. Certain of the strains were issued for fairly large-scale planting in the district, the general behaviour of these being excellent taking the difficult season into consideration.

It may be mentioned that the 40-saw Platt gin in use on the Station is proving invaluable in dealing with seed in the early stages of multiplication.

Fertilizer Trials. As no significant differences in yields have been obtained for several years from superphosphate trials these are being discontinued for the time being.

Crop Rotation. This experiment, as described in previous reports, was continued and gave the results shown in Table I.

TABLE I.
CROP ROTATION EXPERIMENT.

Cropping 1933-34						Yield, lbs. seed cotton per acre.
Soya Bean (very poor crop)	...	...	...	...	...	660
Tepary Bean	...	...	...	...	...	634
Maize	...	...	...	...	...	612
Groundnuts	...	...	...	...	...	590
Sunn Hemp	...	...	...	...	...	578
Sunflower	...	...	...	...	...	629

Difference required for significance ($P=0.05$) 104 lbs.

The early strain 938 was used for the experiment. The high difference required for significance of results is attributed in this and other experiments to the very dry season accentuating minor soil irregularities.

It was noted in the previous year that only a very small crop was harvested from the Soya bean plots. In the preparation of land during the current season, for a repetition of the experiment during 1935-36, Soya plots gave no crop at all and very poor growth was made by plants. Growth of the other five crops was satisfactory, but only small crops were taken.

Spacing. Two experiments were carried out, comparing 12 inches, 18 inches, 24 inches and 30 inches in the row, for the strains 955 and 921. These are totally different types, 955 being a very early upright strain while 921 is a late strain of spreading habit, and it was thought that they might respond differently to spacing effect. The figures for yields, based on eight repetitions for each spacing, do not indicate any difference between the two strains in their response to spacing, and in neither case were the differences in total yield significant. With both strains, however, closer spacing significantly increased the first picking and decreased the second.

Green Manuring. The strain 920 (late maturing) was planted on a field previously planted to Sunn hemp green manure, Sunn hemp seed and maize on the randomized block system. Growth and yields were not good, and no significant difference attaches to the results. An area has been prepared for a repetition of the experiment during the coming season ; further reference will be made to this experiment in connection with a wilt caused by *Verticillium* sp.

Pests and Diseases. Work on insect pest control is directed entirely by this section of the Barberton Station. The work consisted, as in the previous season, of a continuation of the intensive survey of the habits of American and Sudan bollworms and stainers.

Losses from all insects in the district were slight, no peak infestation being recorded, apart from one which damaged irrigated cotton in January. Practically no material damage could be attributed to Sudan bollworm, stainers or beetle. With regard to the latter, it is considered that the control measures adopted on the Station (*vide* previous report) are mainly responsible for its disappearance here.

In the previous two seasons an occasional cotton plant was noted to wilt, with a yellow streaking and ultimate shedding of leaves, with consequent loss of crop. In January this was noted extensively on two fields on the Station, and diseased plants were sent for identification by the Mycologist of the Union Government Department of Agriculture.

The disease is caused by a species of *Verticillium*, and has been recorded in America and from Kakamas in the Cape Province. From the note received on the disease, the cause of its spread appears to be rather obscure. Details of the occurrence on the Station may be of use in this connection.

Cotton was planted on twelve fields of $2\frac{1}{2}$ acres each and, apart from a very occasional plant elsewhere, the wilt appeared only on two fields. On these fields, in March, a very large proportion of plants was seen to be infected. The fields were not adjacent, and were planted to different strains, identical seed of which was used also in other parts of the Station where no disease was noted.

On both of these lands relatively heavy additions of vegetable matter had been given, in one case through green manure and in the other through the ploughing-in of sunflower stalks from which a crop of seed had been taken. It is thought that, since this was the only way in which the previous treatment of these lands differed from the treatment of other lands on the Station, there may be some connection between the addition of certain forms of vegetable matter and the spread of infection.

ROTATION CROPS.

Maize.—Apart from maize grown under irrigation, the crop throughout the district was a failure owing to drought. Several fields on the Station were planted to the American White Flint and Anveld varieties, the yields averaging only 460 lbs. per acre of grain. From a seed selection point of view, however, it is thought that such conditions are favourable rather than otherwise, as, with due regard to other factors, bulk selections taken from a droughted crop are likely to include the best of the drought-resistant types, whereas drought-resistance may be lost in normal seed selection, by the choice of cobs of superior size and appearance after adequate rainfall.

Yields from seed multiplication areas on the Station were sufficiently good to allow of fair bulks of selected seed being taken.

Single-plant selection work was continued on the same principle as that described in previous reports. The strains were planted on 8th February and had no appreciable rain until after flowering had finished. There were very marked differences between the strains in their ability to flower under perfectly dry conditions, and a useful weeding out was possible.

Sunflower.—An area planted to sunflower on 29th December was practically a failure owing to drought. A spacing experiment was attempted but abandoned. The yield of Black Sunflower seed was only 90 lbs. per acre.

Tepary Bean.—This crop was planted on 18th January for a spacing experiment similar to that described for the previous season. The yields, which are based on six repetitions of each spacing, are given in Table II.

TABLE II.
TEPARY BEAN SPACING TRIAL.
(Yield in lbs. per acre).

Inter-row width.	21"	32"	36"	42"
Spacing within rows				
3"	814	692	685	599
6"	625	555	551	566
9"	785	672	578	534
12"	723	658	549	527

The general trend of the above figures shows that, even in a very dry year, close spacing gives the best yields, and that tepary is not able to take full advantage of increased root room.

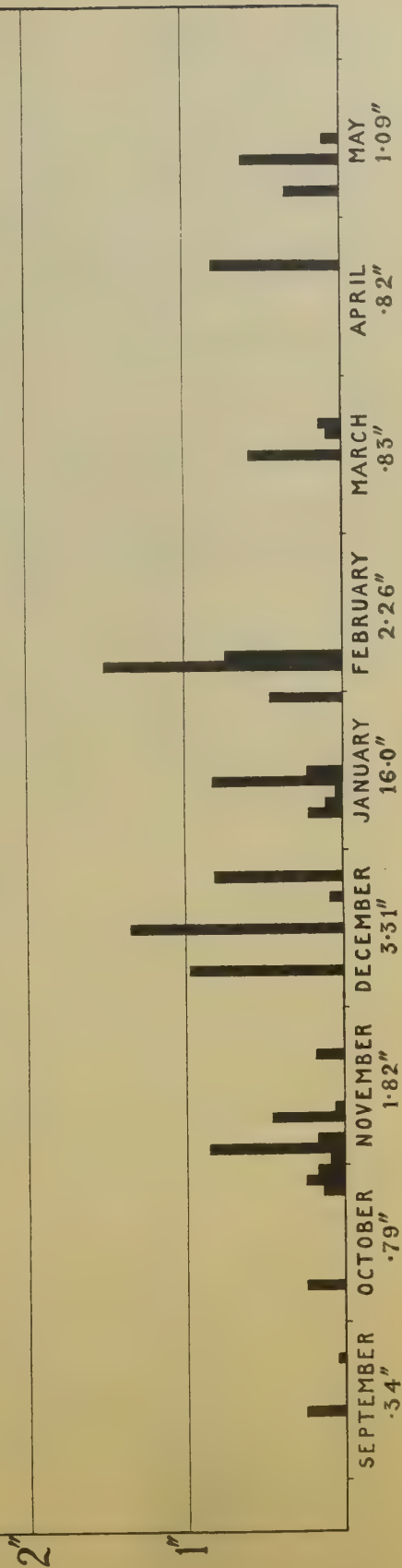
Groundnuts.—In common with other crops, groundnuts suffered badly from drought. The five strains used in previous years were again included in a variety test, with very similar relative yields. The strains Virginia Bunch and Japanese are to be discarded. Spanish 9, Natal and Barberton strains are to be kept for further trials, yields from these three strains being very similar, in the neighbourhood of 460 lbs. of unshelled nuts per acre. Considering the poor moisture conditions this yield is considered good. Planting was carried out on 17th January, and a little over 3 inches of rain fell on the crop.

Mapira.—An area was planted to Mapira, the sorghum which has been described in previous reports, for ensilage purposes. The crop was planted on 17th December, and very fair early growth was made. Later rainfall, however, was insufficient for the needs of this crop, which as a result was a failure.

MAGUT EXPERIMENT STATION, SEASON 1934-1935.

RAINFALL IN TWO-DAY TOTALS.

TOTAL 13.16".



SWAZILAND
COTTON EXPERIMENT STATIONS, BREMERSDORP
AND INGWAVUMA.
PROGRESS REPORT FOR THE SEASON 1934-1935.

BY

J. V. LOCHRIE.

Season and General.—At Bremersdorp.—The season was characterized by a rainfall somewhat below the average for the district and by a very unsuitable distribution. The chief features were (a) conditions of high moisture during the early growing period, (b) severe drought from mid-January until the latter part of March, and (c) a serious attack of aphids which coincided with the spell of drought.

Good rains fell in winter and early spring and these enabled the land to be prepared in good time and all cotton on the Station was planted under good conditions by the middle of November. Stands were excellent and the prospects for the season were bright. The rainfall of December and early January was heavy and the crop was ill-fitted to stand the severe dry conditions which prevailed for the rest of the season. By the beginning of February the plants were heavily attacked by aphids and this, combined with the poor moisture conditions, had an adverse effect on the development of the plants and on the final yields. Damage by bollworm was slight, but the poor growth and flowering rate of the plants afforded little chance of recovery.

At Ingwavuma planting conditions were also good, but the drought which followed was so severe—under 10 inches of rain fell from December to April—that little cotton was reaped and the experimental work described below was carried out on the Bremersdorp Station.

Selections.—In the previous season a number of crosses made by Dr. Harland were grown and selections were made from these. The material received consisted of the following five groups :—

- A. (Cambodia × Jamaica Xerophytic) × U.4
- B. (U.4 × Jamaica Xerophytic) × Upland
- C. (U.4 × Cambodia) × U.4
- D. (U.4 × Gambia) × U.4
- E. (U.4 × Gambia) × Cambodia

The most promising group was C. most of whose members showed resistance to jassid and were of good fruiting types. In the other four groups a considerable number of lots showed definite susceptibility to jassid even in a year when no signs of attack were seen in the general crop. A number of others, mainly in groups A. and B., though resistant to jassid, appear to be too late for this area. Bults were made of all lots showing promise and these, together with a number of selections, were planted this season. As with the variety trials, plant development was poor under the conditions this season and no further selection work was done—all material being retained for planting in the coming season when it is hoped to see the various types under better conditions of growth.

Variety Trials.—A number of trials of strains derived from U.4 were planted and, though the yields were low, the trials gave useful information on the relative merits of the different strains. The main features were :—

1. In all trials the strains under test gave higher yields than the U.4 bulk.

2. As in the previous season of good rainfall the early strains showed up well—the best being 052, 998 and 951. The lowest yielding of these early strains was 955 which is a fine wooded type and probably not sufficiently robust for general cultivation.

3. Of the late maturing strains 921 and its re-selections were again the most promising.

The importance of this continued good performance of the more robust of the early strains is considerable, particularly to the mid-yeld areas where, in general, the temperatures fall quickly in autumn. The native cultivator is primarily concerned with the planting of his food crops and in consequence his cotton planting is often delayed. Under these conditions of delayed planting and falling temperatures in autumn an early type should be most generally successful. Seed of the early types is being issued for multiplication in the coming season.

Spacing.—Experiments were carried out on similar lines to those described in previous reports. A standard row width of 3 feet was used and the row spacings varied from 12 inches up to 36 inches, the latter having a series with one plant per hole and another with three plants. At the wide spacings of 36 inches and 24 inches the plants did not “fill out” and, as in the previous season of good rainfall, the highest yields were obtained from the plots with a high plant density per acre, *i.e.*, 3 feet by 12 inches and 3 feet by 3 feet (3 plants per hole).

ROTATION CROPS.

Maize.—All maize trials and other experiments were planted early in the season. For early-planted maize the conditions were good and yields of 3,000 lbs. to 3,600 lbs. of grain per acre were obtained from the best varieties.

The most promising varieties from the previous seasons were planted, together with bulks of selections from a white flint type. Two of the white dent varieties, Anveld and Hickory King, gave the highest yields—3,600 lbs. and 3,400 lbs. per acre, while the best of the white flint selections yielded 3,300 lbs. The trial was planted in early November and had excellent conditions; the high yield of the long term white dent types was in agreement with previous experience on the station. These dent varieties appear well suited to good conditions of moisture and soil such as are normally experienced in the Station area, but are much less successful in the drier areas in the low veld and where soil conditions are poor. A variety of white flint has shown promise under the latter conditions, and it is interesting to record that one selection from this variety gave 3,300 lbs. per acre this season and in trials was not significantly lower than the dents under the good conditions at the Bremersdorp Station this season.

Selection work was continued, mainly on the white flint types, and strains varying in size and in maturation period have been isolated.

A trial of fertilizer effect was carried out on the permanent layout on which a similar experiment with cotton was grown in the previous season. The treatments were kraal manure alone (KM.) and with phosphates (KMP.), phosphate alone (P.) and with potash (PK.), potash alone (K.) and a series receiving no manurial treatment (Nil).

The experiment was planted at the end of October and yields were high, varying from 3,300 lbs. per acre on the plots receiving kraal manure and phosphate to 2,350 lbs. on the unfertilized plots and 2,100 lbs. on those receiving potash alone. The features of the trial were :—

1. Good effect of kraal manure on plant growth throughout the season.

2. KMP., KM., P. and PK. yielded in that order and were all significantly higher yielding than Nil and K.

3. K. was significantly lower in yield than Nil, and PK. significantly lower than P. This depressing effect of potash on the maize yield is interesting when compared with the results of a similar experiment with cotton on the same site in the previous season. In that test plots receiving applications of potash gave significantly higher yields than plots not receiving potash.

The experiment on rotation effect was carried on for the third successive year of maize following the range of treatments. The experiment and the treatments, which included green manure crops, crops harvested for seed, and bare fallow, have been described fully in previous reports. The results this season indicate that the beneficial effect of green manure crops—sunn hemp and buckwheat—and to a lesser extent that of a year's bare fallow, is still evident after three years. The average yield from the above treatments was 2,360 lbs. per acre compared with 1,980 lbs. following beans and groundnuts.

Kaffir Corn.—This crop is grown mainly by natives and the types in cultivation are for the most part tall and late maturing and of low yielding power. Selection work has been in progress for some years with the aim of producing early maturing and shorter growing types more suited to the local conditions. The season just completed has been one of heavy aphid attack and the only types to stand up to the severe attack were the dwarf selections. The best of these, while being higher yielding and more capable of succeeding under low rainfall conditions, appear to offer definite resistance to aphid and their success on the station received corroboration from the numbers of observation plots which were grown in the native areas. In trials the selections averaged 1,800 lbs. per acre while no crop was reaped from the local type or from the recent introductions, these failing completely owing to aphid.

Beans.—During the past seasons a large range of beans has been tried, the most successful being soya and to a lesser extent tepary beans, and experimental work is now confined to these. The season's experiments with soya and tepary beans were planted as usual in late December and early January. The rainfall in the latter part of the season was very low and the crop, particularly of tepary beans, made very poor growth and little podding. Under these arduous conditions the yield of 750 lbs. per acre from the Y.1 strain of soya bean is very encouraging.

As in previous seasons the effect of phosphate in increasing the yield of these beans was noted. This strain—Y.1—is a yellow seeded type, early maturing and practically non-shattering and it appears well suited for grain production in this area.

In addition to the above grain type, a number of additional varieties have been tried and some of these, being later maturing and of bigger growth, should be valuable as forage crops and for green manure.

Groundnuts.—Variety trials on the lines of those of the previous season were planted in late December. Conditions were good at that

time but the crop suffered severely from the subsequent drought and the yields were low for this station. The relative performances of the varieties in this dry season was similar to that in the previous season of good moisture—the order of yield being Br.2, Br.1 with Spanish, Barberton and Br.3 similar and about 15 per cent. lower than the first group. Japanese, Virginia and Java in that order were much lower yielding and will be discarded.

BREMERSDORP.
DAILY RAINFALL, SEASON 1934-35.

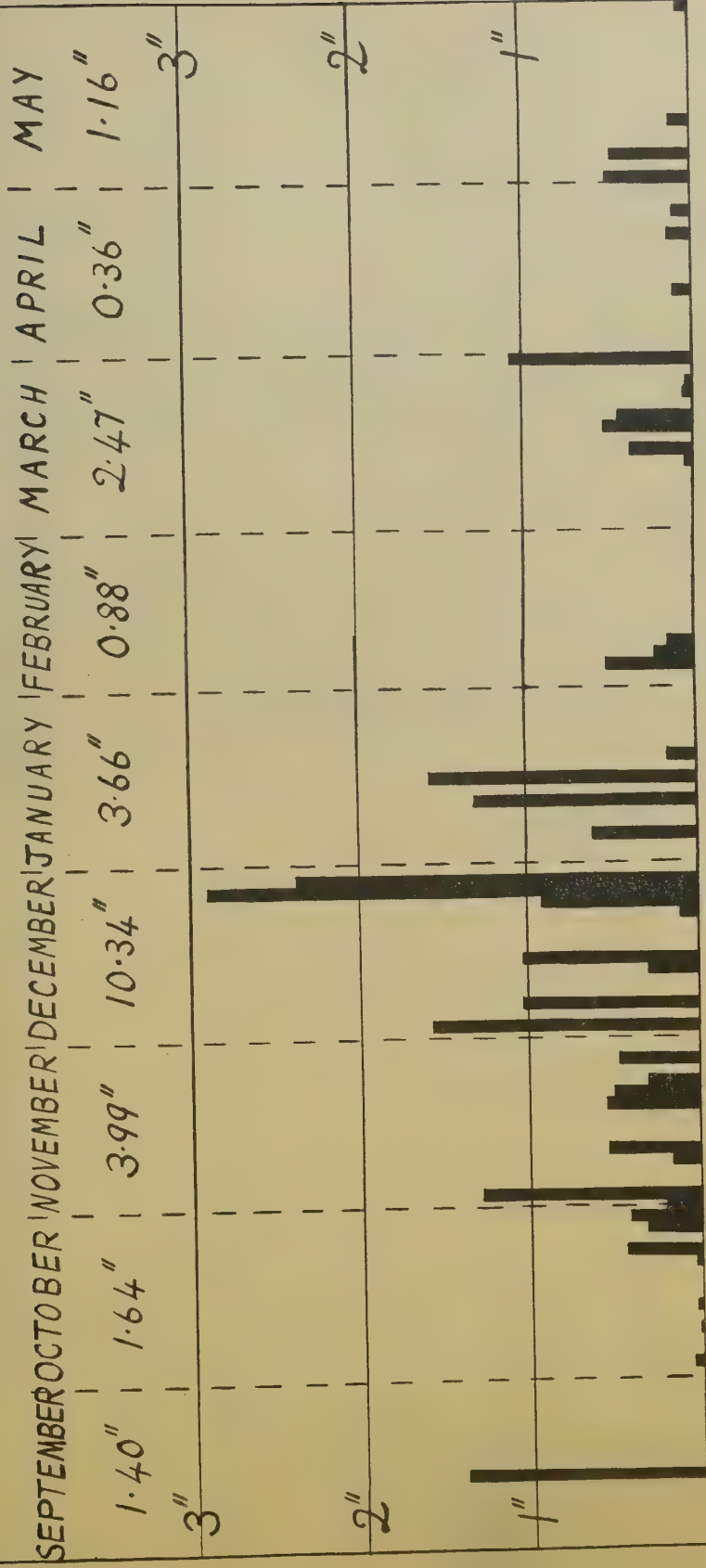
Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1 ...	—	—	—	—	0.20	—	—	—	—	—	0.40	—
2 ...	—	—	—	—	0.33	1.70	—	—	—	—	0.10	—
3 ...	—	—	—	—	0.95	—	—	—	—	—	—	—
4 ...	—	—	—	0.05	—	—	—	—	—	—	—	—
5 ...	—	—	—	—	—	—	0.15	0.52	—	—	0.19	—
6 ...	—	—	—	—	—	0.93	0.46	0.22	—	—	0.28	—
7 ...	—	—	—	—	—	0.10	—	—	—	—	—	—
8 ...	—	—	—	—	0.16	—	—	—	—	—	—	—
9 ...	—	—	—	0.01	—	—	—	0.14	—	—	—	—
10 ...	—	—	—	—	—	—	—	—	—	—	—	—
11 ...	—	1.56	—	—	0.54	—	0.21	—	—	—	—	—
12 ...	—	0.76	—	—	—	—	1.12	—	—	0.11	0.12	0.59
13 ...	—	—	0.95	0.21	—	0.29	—	—	0.03	—	—	0.01
14 ...	—	—	0.45	—	—	1.03	—	—	—	—	—	—
15 ...	—	—	—	—	—	—	—	—	0.35	—	—	—
16 ...	—	—	—	—	—	—	1.57	—	—	—	—	—
17 ...	—	—	—	—	—	—	—	—	—	—	—	—
18 ...	—	—	—	—	0.54	—	—	—	0.47	—	—	—
19 ...	—	—	—	—	—	—	—	—	0.05	—	—	—
20 ...	—	—	—	—	0.50	—	0.15	—	0.43	—	—	—
21 ...	0.54	—	—	—	—	—	—	—	0.01	—	—	—
22 ...	0.19	—	—	0.19	0.30	—	—	—	—	0.13	—	—
23 ...	—	—	—	0.05	—	0.11	—	—	—	—	—	0.21
24 ...	—	—	—	0.40	—	—	—	—	—	—	—	0.04
25 ...	—	—	—	—	—	0.92	—	—	0.04	0.02	—	—
26 ...	—	—	—	—	—	2.40	—	—	0.02	0.09	—	—
27 ...	—	—	—	—	0.27	0.50	—	—	—	—	—	—
28 ...	—	—	—	0.32	0.20	—	—	—	—	0.01	—	—
29 ...	—	—	—	0.41	—	2.36	—	—	—	—	—	—
30 ...	—	—	—	—	—	—	—	—	—	—	—	—
31 ...	—	—	—	—	—	—	—	—	1.07	—	0.07	—
Total ...	0.73	2.32	1.40	1.64	3.99	10.34	3.66	0.88	2.47	0.36	1.16	0.85

Total rainfall for the year, 29.80 inches.

SWAZILAND.

RAINFALL IN 2 DAY TOTALS FOR SEASON 1934-1935.

BREMERSDORP STATION.



SOUTHERN RHODESIA

COTTON-BREEDING STATION, GATOOMA, PROGRESS REPORT FOR THE SEASON 1934-35.

BY
J. E. PEAT.

SEASON.

For the country as a whole the past season has been very difficult. The total rainfall at the Station was 28.58 inches (Fig. 1), but the distribution was not good. Nevertheless, until mid-February the season on the whole was favourable: possibly moisture conditions were too easy, making for a soft, somewhat sappy type of plant. In other districts, however, such as Mazoe and Lomagundi, there was considerably too much rain in the early part of the season, and this seriously checked growth and development.

From mid-February there was a five weeks drought, which came at the critical period for the making of the crop, when the plants were beginning to flower freely. Crops stood up quite well for about the first three weeks, but for the last two weeks they suffered seriously. A recovery took place when the drought broke, especially with crops on better land, and in May plants were flowering again quite heavily. A good late top crop would have been picked from many crops in August and September, had the winter been as mild as those of the last two seasons, but it has been the coldest recorded for many years (Fig. 2); the mean minimum temperature for June and July was little over 40° F., and the mean minimum temperature for the first fortnight in August was around 37° F.; frost occurred twice in August, the first year in which it has been recorded for the Station. This exceptionally cold weather interfered with the development of the top crop. On the better land on the Station a fair crop of late bolls formed, but developed imperfectly, the lint that was picked in August and September being short and soft.

Throughout the country yields have been poor, fair crops for the season yielding only around 300 lbs. seed cotton per acre. Maize yields were also distinctly poor.

FIG 1.

COTTON STATION

GATOOMA 1934-35.

RAINFALL
(2 DAY TOTALS)

INCHES

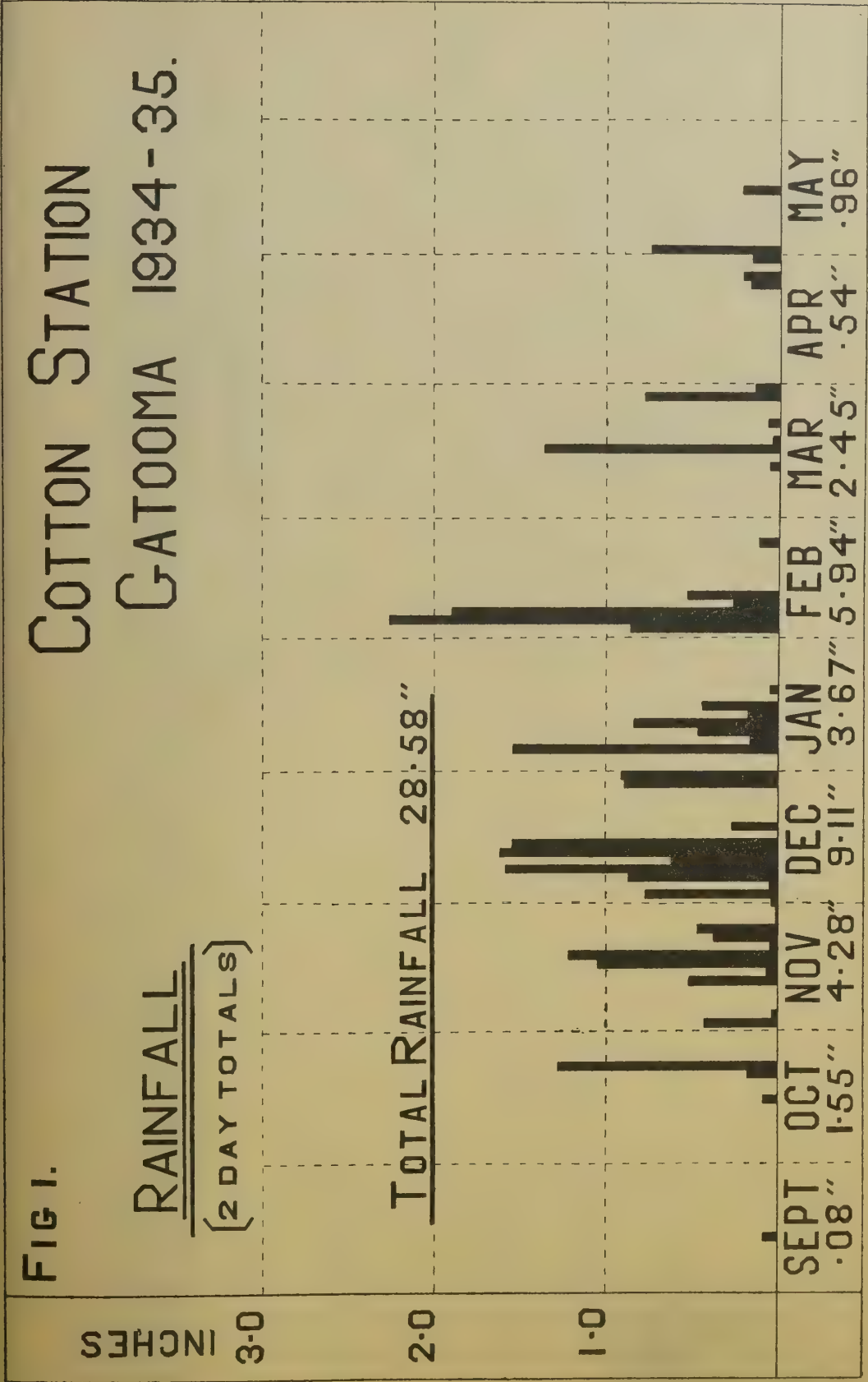
3.0

2.0

1.0

TOTAL RAINFALL 28.58"

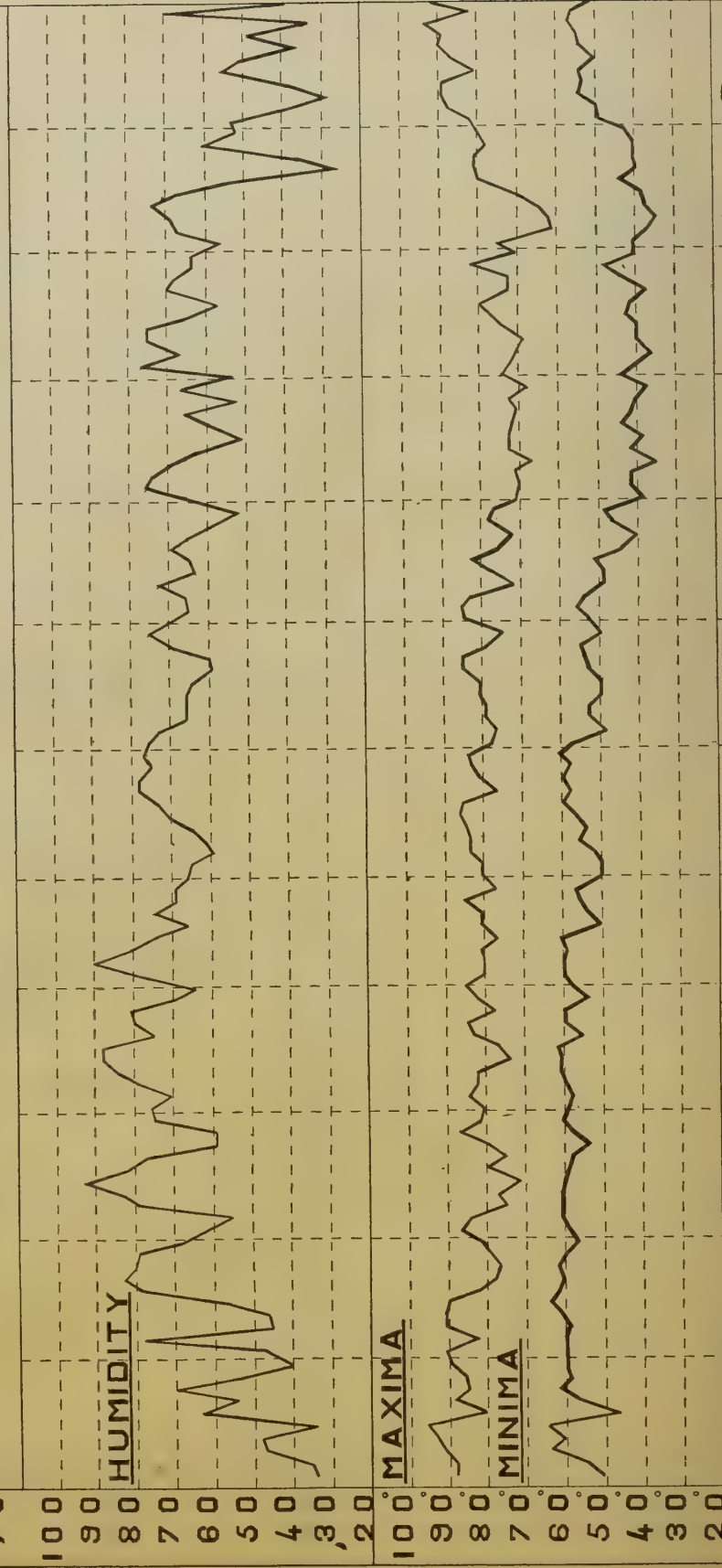
SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
.08"	1.55"	4.28"	9.11"	3.67"	5.94"	2.45"	.54"	.96"



HUMIDITY AND TEMPERATURES COTTON STATION

(3 DAY MEANS)

FIG 2. GATOOMA-1934-35



OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP

Breeding Work.—In a season such as the past, selection work is handicapped, but a fair amount of discarding can be done. As has been mentioned in previous reports, the principal material consists of sub-strains of U.4/64. Again this season these were the lots which, under a fairly wide range of conditions, put up the most satisfactory showing. On the whole, probably the best now at the bulk stage are sub-strains from U.4/64/7/10 (G.5, 11),—U.4/64/7/10/1 lots,—(G. Nos. 5, 30 ; 5, 122 ; 5, 123 ; 5, 124) : U.4/64/7/10/No. 6 (G.5, 79) : and some of the U.4/64/7/1/1 (G.5, 28) lots. Seed of these strains is now being issued to growers for multiplication.

The greater part of the seed which will be used for commercial planting this coming season will be of the two U.4/64 strains, U.4/64/7/10 (G.5, 11), and U.4/64/V (G.5, 21). It is intended that this should be replaced in the next year or two by the sub-strains now being multiplied.

There will be an increase in the number of native cotton plots throughout the country this coming season, and seed is being issued to a number of new reserves.

Altogether 116 of last year's single plant lots are being carried on, mainly from the above-mentioned group of sub-strains. The remainder are from families which, though not in themselves satisfactory, show characters of value, such as marked earliness, marked jassid resistance, and special lint qualities.

Seven of Harland's (U.4 $\times$ Cambodia) $\times$ U.4 crosses are being grown again : the remainder have been discarded as unsuitable.

During the season a series of fresh crosses were made, using the cream of the Station U.4 material, the best Cambodia plants, and a very jassid-resistant, but late, U.4/34 strain.

At the end of the 1933-34 season a number of samples were sent for broker's reports and spinning tests. The lint of U.4/64/7/10 (G.5, 11) appears to spin out rather better than would be expected from the grading. It came first in spinning tests, while valued by the brokers somewhat lower than some of the other strains. This is important, as from field behaviour the U.4/64/7/10 sub-strains are the best lots.

Trials and Development Records.—Strain and spacing trials for the season have not been too satisfactory. But the more crude differences showed up in plot replications, and in the multiplications. In the spacing trials a moderately close spacing, six inches to about twelve inches in the row, gave the most satisfactory yields.

Development records were kept, as in the past years, in crops on the Station, on a farm in Mazoe, and on one in Lomagundi. These show

the effects of the season on the flowering, and the subsequent fate of the bolls formed. They illustrate the extent of the shedding, and how and when that was affected by the drought.

Soil Fertility.—It has been an especially difficult season for crops on shallow and on poor land. Much of Rhodesian soil is markedly deficient in humus. A good deal has been accomplished in the past few years by means of soil conservation measures, storm drains and contour ridging. But sufficient is not being done in the way of adding humus to the soil, improving the moisture-retaining power, and assisting the crop to make an early start. This is of considerable importance in tiding the crop through a February-March drought, such as has been experienced this year.

On the Station green manuring has been practised for a number of years, and a start has now been made in the making of compost on a large farm scale, utilising crop wastes.

American Bollworm.—As a result of the natural shedding caused by the drought, the extent of the American bollworm loss this year has not been so obvious as in some of the past years, but the majority of growers suffered, and a few suffered severely.

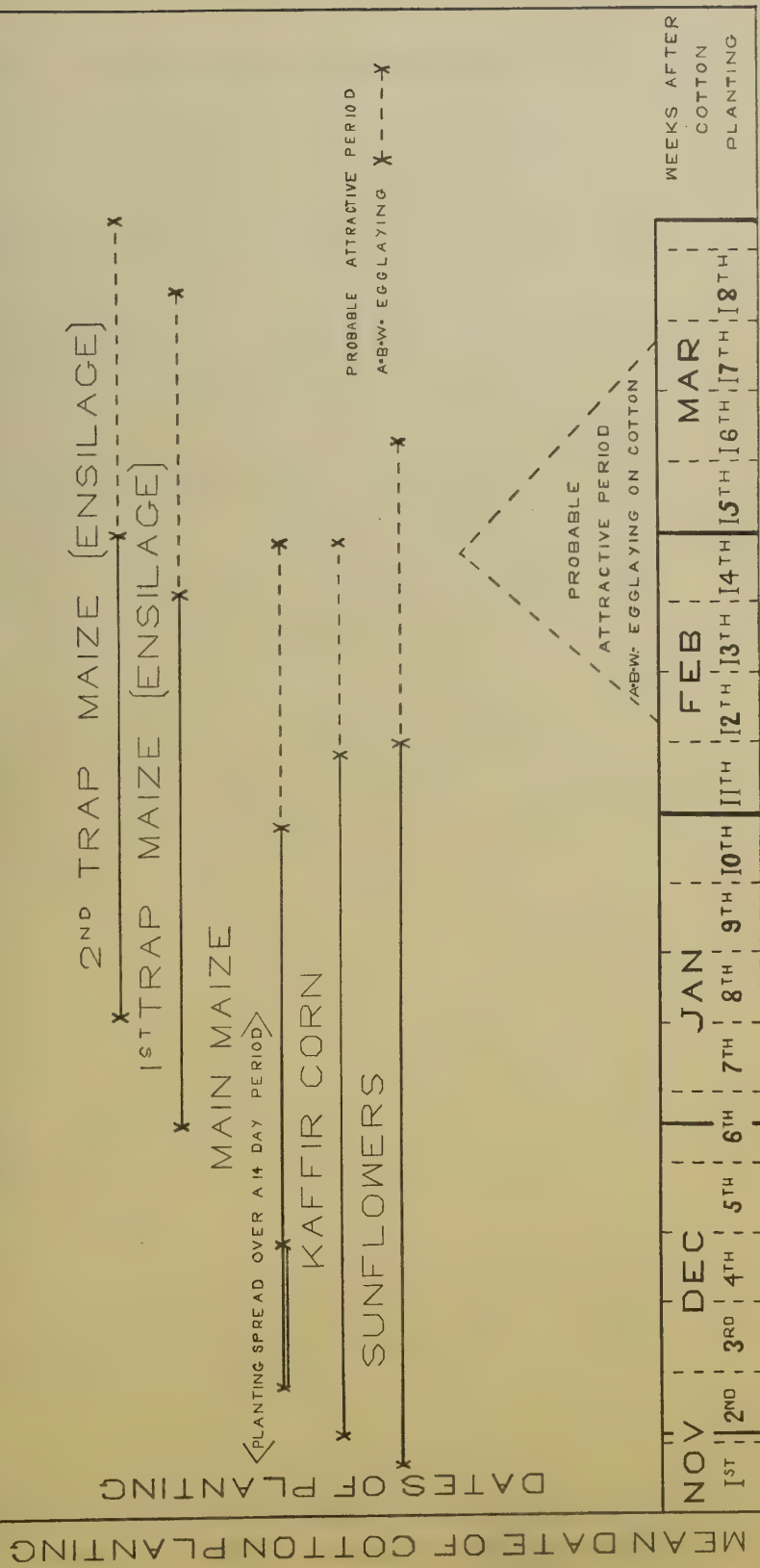
On the Station, as illustrated in Fig. 3, the time of planting of all crops other than cotton was regulated to reduce as much as possible American bollworm egg-laying on cotton. From past recording work it is known that egg-laying on cotton may be expected from about the twelfth to the seventeenth week after the planting of the crop, with the peak egg-laying around the thirteenth and fourteenth weeks. The period after planting at which other crops are attractive to American bollworm egg-laying is also known.

In the maize-growing areas many growers start planting the maize crop dry, just before the rains break. They continue planting more or less steadily until their intended acreage has been completed. Thus there is always a considerable amount of early planted maize to attract the egg-laying of the American bollworm moths before cotton is fully attractive. But when the maize planting has been completed fairly quickly, say by the first week in December, there is much less cover when the cotton is getting into full flower.

This past year the Station maize was planted over a period of a fortnight, later than is normal for commercially planted maize. Planting through the middle fortnight of December, gave tasselling protection more or less throughout February. Late blocks of trap maize were planted at the end of December and early in January.

SCHEMATIC PLANTING PROGRAMME
COVER AGAINST AMERICAN BOLLWORM

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Blocks of earlier maturing maize, such as Anveld and White Congo, were included. A portion of these blocks, when reaped, was used for ensilage. As seen in Fig. 3, areas of kaffir corn and sunflowers were planted so that they too were flowering at the optimum time to assist the American bollworm-cotton position.

Full egg-laying records were taken on the different sections of all the crops grown. Records of natural egg parasitism were taken on the cotton sections and on maize. In addition larval records were taken on the cotton sections.

The periods of egg-laying on cotton and on the various plantings of other crops, more or less coincided with the time periods anticipated. (Fig. 3.) The acreages of these other plantings relative to the cotton acreages were probably greater than could be arranged on a commercial scale, yet during the attractive periods of these plantings comparable American bollworm egg-laying still went on in cotton. All American bollworm egg-laying, however, was on a considerably lower scale than last year.

Peak egg-laying on one block of commercial maize on the Station was around 4,000 eggs per acre per day, with a cotton peak, in the same block at the same time, also around 4,000 eggs per acre per day. In this block the egg-laying on the later trap maize reached 6,500 eggs per acre per day. In another block the main maize peak was around 8,500 eggs per acre per day, compared with a cotton peak at the same time of 6,000. In that block the later trap maize peak was also around 6,000.

Similar records were taken on two farms, one in Mazoe and one in Lomagundi. On the one the results were much the same as on the Station. On the other, where, as a result of the difficult growing conditions, plants had been checked and flowering was low, egg-laying on the cotton was negligible, whereas considerable egg-laying was recorded during the critical period in blocks of attractive maize, and in areas of tobacco in flower.

On the whole it seems that the American bollworm egg-laying is more or less spread over crops flowering at the time. Where cotton has grown out reasonably well and is flowering freely, areas of maize at the tasselling stage are only slightly more attractive than cotton. Tobacco in flower seems to be considerably more attractive.

It is probably well worth while, however, having areas of crops other than cotton in flower during mid-February and early March. Without such additional attraction, the moth population, which up till then has been scattered through the large acreages of commercial

maize, apparently tends to be concentrated into the smaller areas of cotton then coming into full flower. But if maize and other crops are also attractive at this time, the egg-laying is probably to some extent distributed, thus alleviating the position, and reducing the chance of a crippling American bollworm attack.

Growers are being advised of the necessity, in the first place, of planting their cotton crop early, as one of the first crops to be sown after the planting rains. In the normal course of events, therefore, the first of the cotton flowering will be protected partially by the tasselling of the main maize crops.

Secondly, it has been suggested that as much as possible of the maize in the vicinity of the cotton area be reserved for planting, up to about the end of the third week in December. As seasons are so erratic, there should not, over a period of years, be much, if any, loss in total maize yield, arising from a portion of the ordinary commercial maize crop being late planted. Although in most years early planted maize probably does best, there are also years when December plantings do well.

Thirdly, it has been suggested that ensilage maize be planted about the end of December and beginning of January. Further, where it can be done without adversely affecting the yields, growers should attempt to regulate the time of planting of other crops so as to give further American bollworm cover for the cotton. These times of planting are for a fairly normal season, with cotton planting in the last fortnight in November. With later planting rains, the times of planting would have to be adjusted accordingly. Such time of planting arrangements should assist the American bollworm-cotton position with little cost or trouble to the grower.

This last season the amount of American bollworm egg-laying was very small compared with that of last year, but the egg survival was much greater : larval counts were not so very much less than last year. A detailed pinning of eggs on marked plants in cotton, from the end of January to mid-May, showed an egg hatching of around 80%, with a hatching during the peak period of egg-laying, mid-February to mid-March, of apparently somewhere about 75%. Natural parasitism by *Trichogramma lutea* was much less than last year, although higher in egg collections from maize than from cotton.

Sudan Bollworm—As in the previous year, records were taken in a standover block of cotton. Egg-laying commenced in fair numbers early in November, probably as a result of moth emergences after the first good rain towards the end of October. Egg counts increased after

mid-November, and from then until mid-December were around 40 eggs per 100 plants per day, on a good stand at close spacing. Egg-laying fell away towards the end of December and in January.

In the autumn of 1934 over a thousand fourth and fifth instar Sudan bollworm larvæ had been allowed to complete their feeding in cages, and there to pupate. Records of moth emergence agree with the egg-laying records in the standover block : moths emerged steadily from early November. The main emergence period was during the latter two-thirds of November and throughout December. Emergences were less in January, and less still in February.

Probably as a result of the trapping of the egg-laying of the emerging moths on standover cotton, which has been practised for the last two years, and described in the last Report, Sudan bollworm egg-laying on the annual crop on the Station was again low, just slightly behind that of last year. Until late in March it was negligible, and the peak at the beginning of April was under 30 eggs per 100 plants per day, after which it fell away again steadily throughout April.

While there are undoubtedly dangers in using this method of trapping on a commercial scale for reducing a local Sudan bollworm population, it appears to be a successful method under the conditions at Gatooma. The records of moth emergence and egg-laying on the standover traps show at the same time how impossible cotton-growing would be if ratooning, and leaving crops to stand over, were extensively practised.

Stainers.—Throughout most of the country stainer damage has been below normal. On the Station, adult stainer populations were much the same as last year. *D. fasciatus* and *D. intermedius* were present in fairly small numbers in March, April, and into May. *D. superstitiosus* was much less common. The breeding of *D. fasciatus* increased rapidly in the latter part of May and through June into July.

As last year, in addition to population records, estimates have been made of puncturing and staining in the developing bolls, and staining of the mature crop. The staining of the Station crop was low : about 80% to 90% of the mature locs during the main picking period could be graded as unstained or very lightly stained. A comparison of puncturing records with staining records in bolls three weeks to a month old shows less staining than might be expected from the records of puncturing.

At the Bindura ginnery all seed has been examined for soundness and classified on this basis. On the Station this year the main seed lots for issue are 75% to 85% sound.

Stainers and Sudan Bollworm in the Sabi Valley.—In the South Eastern corner of the country, in an area of low altitude very different from most of the existing cotton-growing areas in the country, experiments are being made with cotton-growing under irrigation. It is an area fairly densely populated with baobabs, with, in addition, *Sterculia*, other stainer host plants, and quite a scattering of wild cotton plants.

As the results not only affect the immediate area, but give a guide to what may be expected in other similar areas throughout the country, they are of considerable importance. A native recorder has therefore been stationed in the area for the past year.

Cotton crops planted in October, November and December suffered heavily from stainer and Sudan bollworm. A small bottom crop was picked from the October plantings, but in the later plantings the crop was a complete failure. This past season a series of "out of season" plantings were made, earlier and later than these. Areas planted from July to September were also a complete failure; Sudan bollworm and stainers, predominately *D. fasciatus*, with small populations of *D. intermedius* and *D. nigrofasciatus*, played havoc with the crops. Plants on the better soil had grown out well and had made a very satisfactory type of fruiting growth; they had flowered and balled in a style to have given a very heavy crop.

From the records, Sudan bollworm egg-laying had become negligible this year by the beginning of April, and stainer populations had dropped to small proportions by the end of that month. Crops planted in February–March were still, in mid-October, carrying only a small stainer population, and Sudan bollworm egg-laying was still negligible. A crop of clean, unstained cotton had already been picked, and, at that time, when this Report was written, the majority of the developing bolls on the annual crop, and on a ratooned block nearby, were free from staining. The past winter, even in this area of low altitude, has been an exceptionally cold one, however, and this may have affected stainer movements. Rain-grown cotton in this area is out of the question because of stainers and Sudan bollworm, and an earlier planted irrigated crop seems to be as badly attacked. But it may be possible here to grow cotton under irrigation, planting in February to March, and reaping in September to November. This coming season careful records will be taken on a further area of February-planted cotton, and arrangements have been made for plots to be planted at the same time in a native irrigation scheme nearby.

Records were kept of stainer movements on the host plants, together with records of the flowering and fruiting of these hosts. By far the most important host appears to be the baobab, carrying predominately *D. fasciatus*, and more occasionally *D. intermedius*. Records have also been made of stainer movements on *Sterculia*, *Thespesia*, wild cotton, *Abutilon*, *Hibiscus* spp. and on three non-malvaceous shrubs, one a *Cassia*. By May, very few stainers were found on host plants except on baobabs in fruit. Even fewer were found in June and July. In August, September, and so far in October, no stainers have been observed on the host plants.

The Sudan bollworm host is wild cotton, though *Thespesia* may act in this capacity to a small extent.

Insect Pests other than Bollworm and Stainers.—In the early part of the season trouble was caused by locusts, but fortunately little damage was done on the Station.

It has been a mild jassid year, and little progress could consequently be made with testing for jassid resistance in the breeding work.

As was to be expected with the type of season experienced, aphid attack was severe, especially during the drought period in February–March. The aphid attack must have played a considerable part in weakening the already strained plants.

NORTHERN RHODESIA.
RESEARCH STATION, MAZABUKA.
PROGRESS REPORT ON THE COTTON WORK,
SEASON 1934-35.

BY

A. G. BEBBINGTON (*Empire Cotton Growing Corporation*) AND W. ALLAN
 (*Northern Rhodesia Department of Agriculture*).

SEASON.

Some delay in planting was occasioned by the lateness of the first rains followed by a period of wet weather when no planting could be done and which in some cases necessitated re-ploughing of land to be planted.

The presence of diffuse flying swarms of the Red Locust (*Nomadacris septemfasciata*) which were not readily dislodged caused defoliation of the maize crop in late January and early February and must undoubtedly have affected the bollworm egg records on this plant. A drought of six weeks in February and March caused a very low flowering rate, which was offset to some extent, however, by a lower incidence of insect pests than is usual. Jassid did not occur in quantity, while damage from American bollworm (*Heliothis obsoleta*) was negligible as compared with the previous season. The incidence of Stainer (*Dysdercus*) followed the usual course, but the influx of *D. supersticiosus* was below the "normal" level, while *D. fasciatus* appeared somewhat later and a high peak population was not reached until June.

COTTON EXPERIMENTS.

Yield Trials.—A strain trial of eight strains of U.4 laid out in a randomised block with eight replications was carried out. The results were inconclusive.

Spacing Trial.—A trial of three spacings laid out in a randomised block with ten replications was carried out, but failed to give a significant result.

Selections.—Eighteen single plants were carried forward from the previous season and these were planted with a number of strains from Barberton and Gatooma. No re-selections were made from these,

but they will be grown again in observation plots in the coming season. Ninety-four strains which had proved the most jassid-resistant of 195 received from Trinidad were planted. All have now been discarded with the exception of 43 strains from the cross (U.4 $\times$ Cambodia) $\times$ U 4, which is, without doubt, the only one of these crosses suited to Northern Rhodesia.

Seed Distribution.—There were no requests for seed from European farmers and none was issued. The insect work has indicated that in the areas occupied by European farmers very heavy attacks of stainers and bollworm are to be expected regularly and we have therefore discouraged farmers from growing cotton except as a rotation crop and for cattle food.

It has been decided on the evidence provided by the insect work to discontinue formal experimentation at Mazabuka as it can give little or no information which would be of value in the areas likely to be developed.

INSECT WORK.

Bollworm.—The attack of American bollworm (*Heliothis obsoleta*) during the season was negligible. Egg counts were carried out on maize, sorghum and groundnuts in an attempt to determine their efficacy as trap crops. The layings recorded on all these crops were very light and there were no definite peaks of oviposition during the season. In view of the proposed developments of native cultivation of cotton, egg counts on other native crops are to be carried out in the coming season.

Stainers at Mazabuka.—The recording of stainer populations on cotton and on the wild hosts at Mazabuka was continued on the same lines as last year, and, in the main essentials, records were in agreement with those of previous seasons.

Dysdercus supersticiosus.—The host sequence of this species was precisely the same as that recorded last season. A wandering population of *D. supersticiosus* was first recorded in December, though in other seasons considerable numbers had been recorded during November. The wandering stainers concentrated on *Thespesia rogersii* at the time of abundant flowering, but no breeding took place on this host. When in late December, *Hibiscus trionum*, the early flowering host of most importance, began to flower, the stainers disappeared from *Thespesia* and an increasing population was recorded on the *Hibiscus*. A single generation was bred up on *H. trionum* and in February the plants dried up and died, forcing this generation to wander in search of food. Again the first appearance of the stainer

on cotton coincided with the beginning of this movement from the early flowering hosts. The later hosts, *H. asper* and *H. cannabinus*, did not begin to flower until late March and their flowering peak was reached in April. As in previous seasons, there was a decline in the population of *D. superstitiosus* on cotton coinciding with a rapid rise in the numbers recorded on these late flowering hosts. The numbers of *D. superstitiosus* recorded on cotton were very much less than in previous years. This was apparently due to the small size of the parent population which appeared in December and to the correspondingly small F_1 generation bred on *H. trionum*.

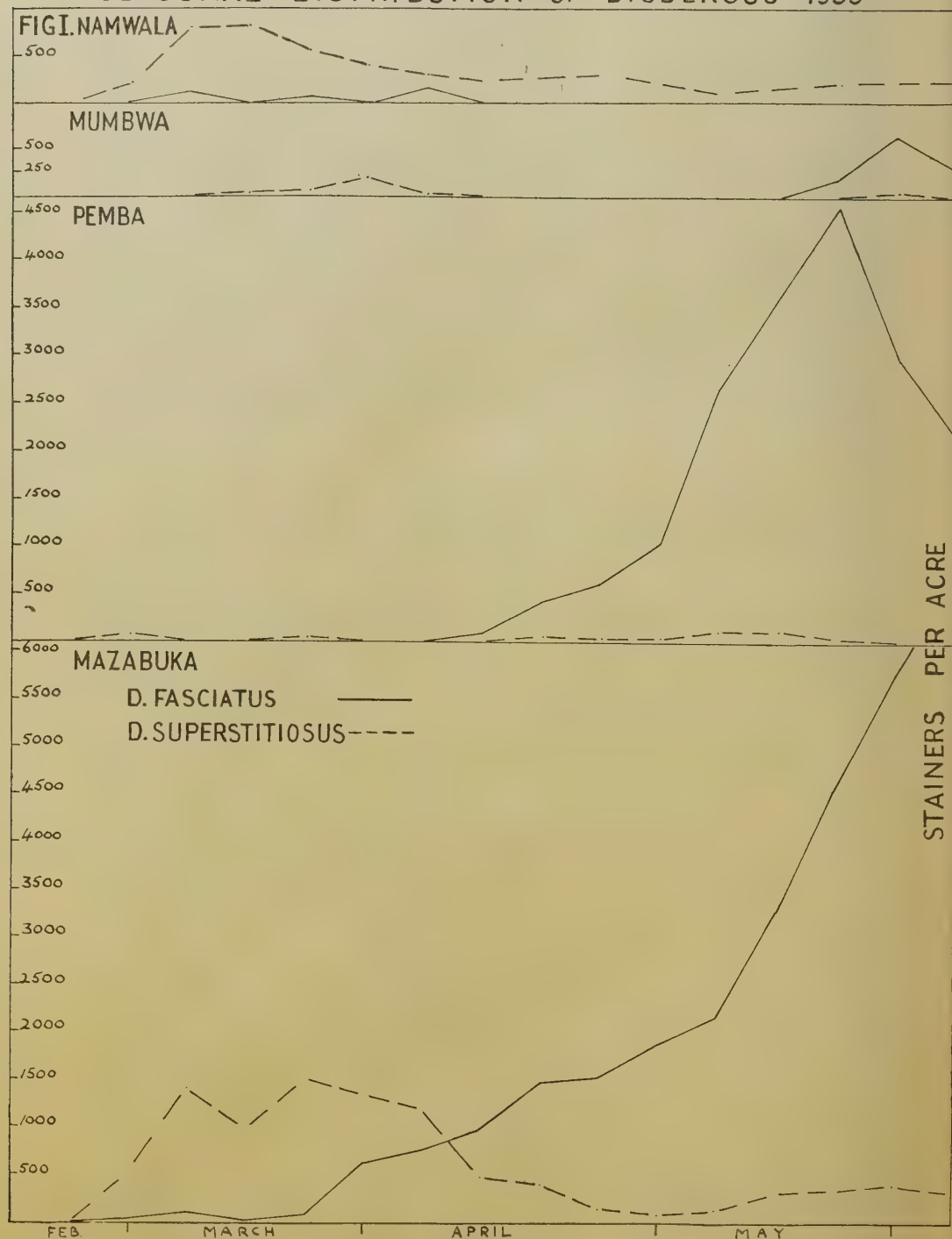
Dysdercus fasciatus.—The population of this species which survived the late dry season of 1934 on *T. rogersii* was exceedingly small, partly owing to the small amount of crop remaining on the trees, and partly to defoliation caused by locusts. This was reflected in a somewhat late appearance on cotton and the influx was considerably smaller than usual.

THE RELATION BETWEEN VEGETATION AND STAINER INCIDENCE ON COTTON.

The investigation on this subject which was commenced in 1933–34 was continued and extended. A series of half-acre plots, grown by natives, were laid down in each of three areas, Pemba, Namwala and Mumbwa. Native assistants, who have been trained for some years at Mazabuka, were stationed in each area and carried out continuous recording of stainer populations on cotton and on the wild host plants occurring in the areas. The stainer distributions so recorded are shown in Fig. 1 and that for Mazabuka is given to provide a comparison.

Pemba.—It will be seen that here the first attack of *D. superstitiosus* is negligible in extent, while the attack of *D. fasciatus* is apparently less severe than that at Mazabuka. The reason for the comparative absence of *D. superstitiosus* on cotton was clearly demonstrated. *H. trionum* is absent from the area, but there does occur an abundance of a *Hibiscus* spp., as yet unidentified, which begins to flower in late February. *D. superstitiosus* makes its first appearance just as this host comes into flower. The influx of this species into the Pemba area at this time is probably to be explained by the movement of a population from adjacent areas wherein *H. trionum* occurs. This incoming population concentrated on flowering Hibiscus and very few stainers appeared on cotton. The development of the *D. fasciatus* attack was expected because *T. rogersii* does occur in the area, though less abundantly than at Mazabuka.

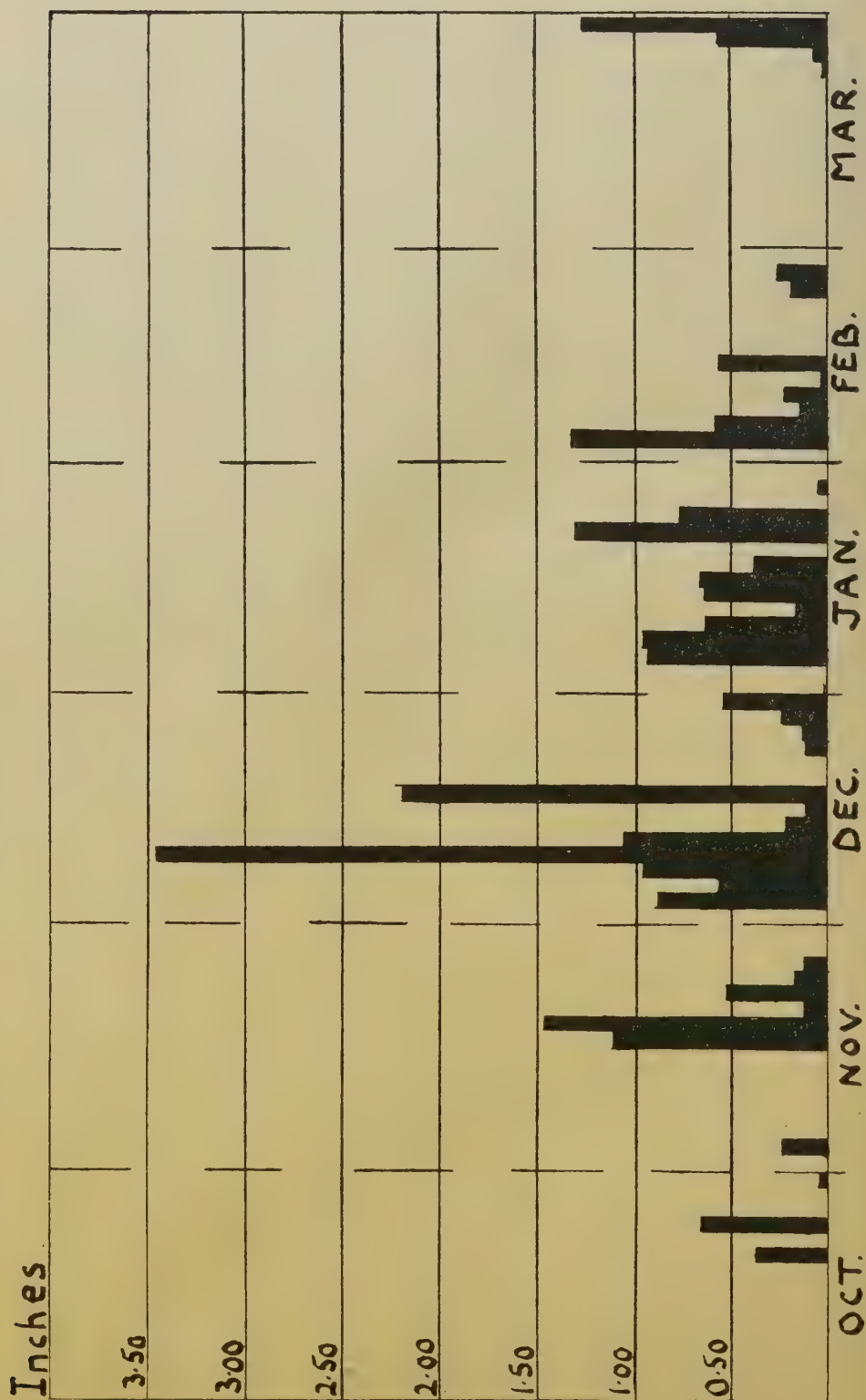
NORTHERN RHODESIA SEASONAL DISTRIBUTION OF DYSDERCUS 1935



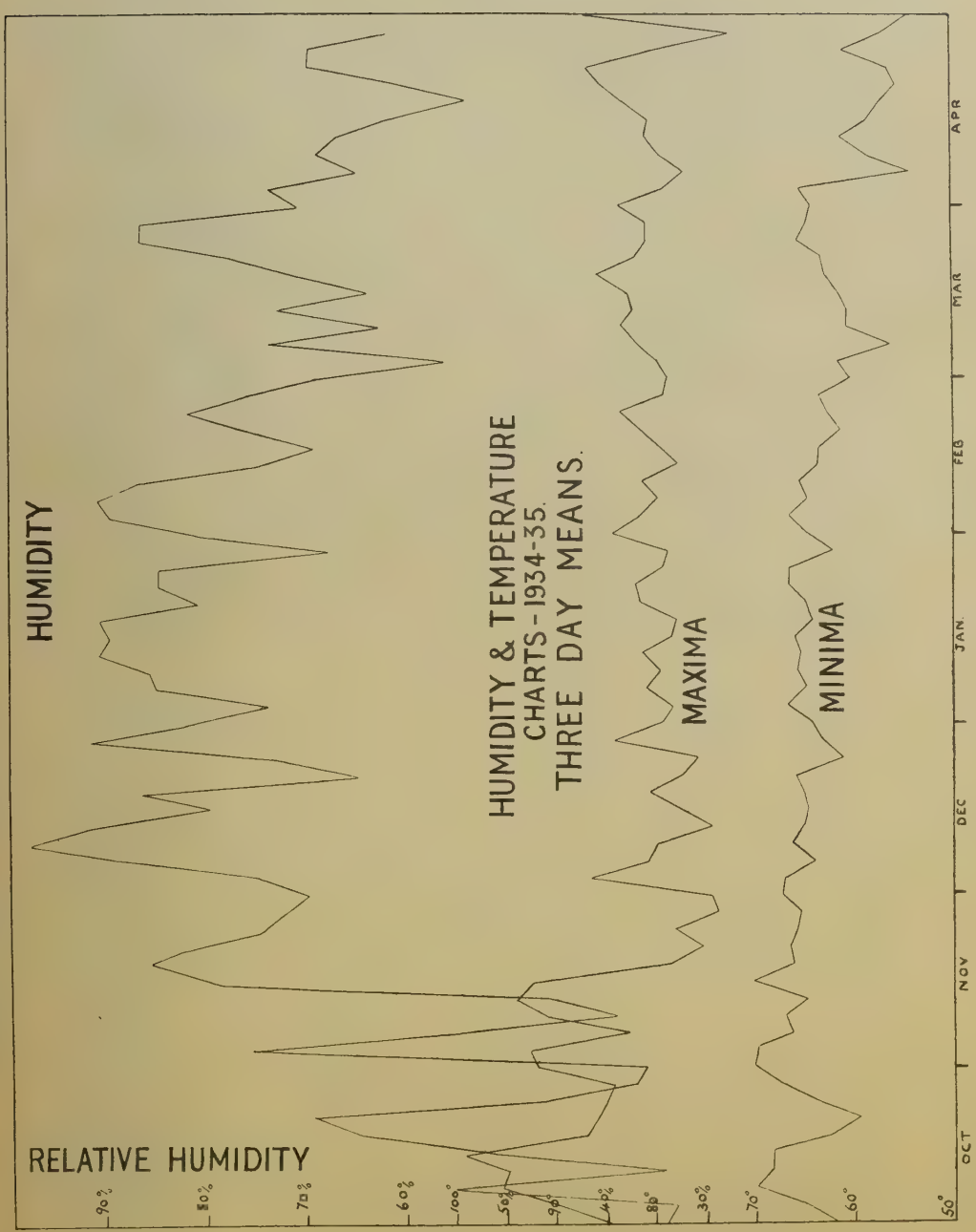
Mumbwa.—These plots gave results similar to those obtained at Pemba. Here again an early flowering *Hibiscus* species diverted the *D. superstitiosus* attack from cotton. The attack of *D. fasciatus* recorded was in agreement with the observed distribution of *T. rogersii* in this area. A single plot was sited in a small isolated patch of country of the Mazabuka type to act as a "control." On this plot the stainer attack was comparable with that recorded at Mazabuka.

Namwala.—The series of plots covered country with vegetational characteristics varying from the Mazabuka type to Kalahari sand and ranging through intermediate types of country. Within the Kalahari sands hosts of both stainer species are rare or absent. Stainer attack on the first plot was again comparable with that at Mazabuka, while on the Kalahari sands plot no stainers were recorded. The degree of stainer attack on plots between the two was also in close agreement with expectation. The plots at Namwala Boma may be taken as an example. In this area the *Hibiscus* host sequence is similar to that at Mazabuka but *T. rogersii* is rare. An early and severe attack of *D. superstitiosus* is therefore to be expected, while the attack of *D. fasciatus* should be of a negligible order. The actual distribution obtained (Fig. 1) was in agreement with this expectation.

NORTHERN RHODESIA - MAZABOUKA STATION



RAINFALL 1934-35 2-DAY TOTALS



ANGLO-EGYPTIAN SUDAN
PROGRESS REPORT ON THE WORK ON COTTON
CARRIED OUT BY THE PLANT BREEDING
SECTION, AGRICULTURAL RESEARCH SERVICE,
SEASON 1934-35

BY
TREVOR TROUGHT.

GENERAL.

Organization and Staff.—Towards the end of the season it was finally decided that, as part of the general reorganization of the Agricultural Research Service, the Headquarters of the Plant Breeding Section should be moved to the Gezira Research Farm, Wad Medani ; Shambat will still be retained as an experimental and propagation area, and a sub-station will be opened in the Nuba Mountains.

Work on Egyptian types will be carried out in the Gezira, and on American types in the Nuba Mountains. At Shambat, experiments with leaf curl and blackarm-resistant types and parallel culture work will be continued, as well as propagation work.

Government approval was given to the appointment by the Empire Growing Cotton Corporation of Mr. R. R. Anson, recently of Fiji, as a Plant Breeder on the staff of the Section.

Climate.—During the growing season there was nothing exceptional in the weather. Maximum and minimum temperatures were about normal, and humidities were possibly rather less than usual during November to February. Rainfall was a trifle over average, and during May and June was a little exceptional, as there was rain on five days in May and on ten days in June.

DEVELOPMENT OF THE CROP.

(a) *At Shambat.*—Throughout the season, growth in height was more rapid than in the previous season, but node development was slightly less rapid. Early flower production was appreciably more than in 1933/34, and the final boll production greater. At the same time the proportion of healthy bolls to diseased bolls was much higher in 1934/35, but the final yield per feddan was not as high as this higher proportion indicated.

There was again a very severe Pink bollworm attack, but leaf curl was not severe.

(b) *Other Stations*.—The Varietal Tests at the Gezira Research Farm were again severely affected by white ant attack. The Barakat Experiment, however, was thoroughly satisfactory, growth being vigorous and uniform.

In the Nuba Mountains yields per feddan were well below the yields obtained in 1933/34 on account of short rainfall at sowing time. The yields in Mongalla were also less than those of the previous year.

(c) *Diseases and Pests*.—At Shendi (Northern Province) Pink bollworm was very destructive. Disease did no serious damage at Shambat, though blackarm appeared on the X1530A (sown on July 11th) and continued active till November. On the 24th of September leaf curl first appeared, but never became severe. Pink bollworm did serious damage at this Station also. The attack was quite as severe as in the previous year.

EXPERIMENTAL.

(a) *Pedigree Line Breeding and Hybridization*.

1. *Egyptian (and Sea Island) Types*.—The majority of families grown at Shambat were duplicated at Medani in "Parallel Cultures." At Shambat the Pedigree families were sown on the 7th August, a rather earlier date than usual. At both places growth was good. A number of the families gave good promise for the future. Among these were re-selections from X1530A and X04729. Both X1530A and Gezira Main Crop Sakel were sown as control families.

A large number of hybrid families was grown. These included F_3 families of Sea Island $\times$ Ishan and back-crosses on to the Sea Island parent. A feature of certain of these back-crosses was their uniformity.

Crosses were made between X1530 types and Nye's blackarm-resistant types from Uganda, as the first stage in the back-crossing programme which it is hoped will lead to a blackarm-resistant Egyptian type.

Selections of Sakel types, which, in the field, appeared to show resistance to blackarm infection were made in the Gezira area by the Plant Pathologist at Medani.

2. *American Breeding Plots*.—In these growth was excellent, and, discounting the general attractive appearance due to the favourable season, some families were really good, particularly selections from "514A" (an original Pump Scheme Strain selection) and "511B" originally derived from Uganda (S.G.85). The "513" (Early Strain) families selected for improved lint quality retained their heavy yielding and early maturing qualities unimpaired. There were, in all, 212 families grown at Shambat and 25 families at Talodi and Kerripi, which were not represented at Shambat.

Trial was made of 65 new hybrids from Trinidad and 47 re-selections from Trinidad hybrids grown in previous years. A feature of some of these families was their vegetative uniformity despite their hybrid origin, and their unusually fine, long lint.

The production of blackarm-resistant types reached the stage of F_1 families of Nye's Uganda types crossed with "513" and "514." These were sprayed with *B. malvacearum* suspension in water, and records made of their comparative resistance. It was found that the F_1 's were intermediate in their resistance to attack, the "513" hybrids being appreciably more resistant than the "514" hybrids. Families from the resistant parents retained their resistance.

Parallel culture work in the Nuba Mountains and Mongalla was not satisfactory, owing to poor germination at first sowing and shortage of seed for re-sowing. Pedigree line work will replace this parallel culture work in future.

(b) *Cotton Propagation.*

(1) *Egyptian Types.*

At Shambat.—Twenty feddans of X1530A were grown. The seed for this came from the "Nucleus area" of the 1933/34 roguing plot. In spite of a heavy Pink bollworm attack the yield was 4.45 kantars per feddan.

Two "Nucleus roguing plots" of X04729 types with differing boll shapes were grown. The long-bolled type yielded 1.96 kantars per feddan and the round-bolled type 3.44 kantars per feddan. Bulk single plant re-selections were made from the latter type.

Other small propagation areas, to produce sufficient seed of new types for testing, were also grown.

In the Gezira, Gash and Tokar Areas.—The propagation and yields of X1530 were the main items of interest. On over 12,000 feddans in the Gezira, over 13,000 feddans in the Gash Delta and over 1,500 feddans at Tokar the average yield of X1530 was nearly one kantar per feddan more than the average yield of Sakel—an increase of 20% or more.

(2) *American Types.*

A roguing plot of 513 ($14\frac{3}{4}$ feddans) was grown at Shambat. This was sown on the 3rd of July, 1934, and gave a final yield of 7.40 kantars per feddan. The plot was on poor soil, but was manured with ammonium sulphate at the end of August.

XA129 (a Pump Scheme Strain selection) was grown on 100 feddans at Kulud, in Dongola, and on 55 feddans near Torit in Mongalla.

Fifty feddans of XA1129 were sown in the Kadugli District as a large-scale trial, and to provide seed for further propagation. Two Nucleus

roguing plots of 511A (selected originally from Uganda S.G.85) and 514A (a selection from the Pump Scheme Strain) were grown at Shendi. These plots were badly damaged by floods during the high Nile, but, fortunately, some seed was obtained.

In addition plots of 511A, 513A, 513B and 514B, to produce seed sufficient for large scale tests, were grown at Shambat.

(c) *Field Tests.*

(1). *Egyptian Types.*

(a) *Line Test at Shambat.*—The control type was X1530A. Consequently increases over controls were neither frequent nor large. NT13/34 (an X04729 type) showed a 25% increase, and NT3/33 and NT10/34 (leaf curl-resistant Sakel types) also showed small increases.

(b) *Trial Line Test at Gezira Research Farm.*—Growth was exceptionally good, and in consequence comparisons of “vegetative vigour” were difficult to make.

NT13/34 again showed up well (15% increase). X1530B gave 20.5% increase over the X1530A controls. At Shambat this type showed no real difference from the control. The fine-lined Gash Sakel types, NT2/33 and its successor NT9/34, were slightly better yielding than the controls, but seemed rather more susceptible to thrips.

(c) *Preliminary Varietal Test.*—This was a trial of three new types with X1530A as control, at two sowing dates, with five replications.

Varieties.	Sowing Dates.
X1530C	I August 17th.
X1530A	II August 30th.
NT2/33	
508A	

White ants attacked the young plants during September and October, and ruined the stand. Blackarm was negligible on all varieties, and leaf curl only developed on NT2/33, on which it became general during the later (2nd growth) period.

In spite of the severe white ant attack, which must have introduced large errors, the analysis of variance showed significant differences between each pair of varieties, and between sowing dates. The varieties are placed, in the list above, in descending order of actual yields per feddan.

(d) *Varietal Test, Gezira Research Farm.*—This was a comparison of five varieties, sown at two sowing dates, with and without manure.

Varieties.	Sowing Dates.	Manure.
X1530A	I August 16th	200 rottles of ammonium sulphate per feddan, buried between the ridges seven days before sowing.
X1730A	II September 5th	
X04729		
X730		
Gezira Main Crop (Egyptian Sakel)		

Here again severe losses from white ants produced wide differences between the stands of different sub-plots. Blackarm infection was negligible and leaf curl only affected the Gezira Main Crop Sakel seriously. At picking time, areas of bad stand were cut out, and bed yields obtained by multiplying the yields from the reduced areas of better stand by appropriate factors. Statistical analysis of these figures showed significant differences between yields of each variety. The varieties in the above list are given in descending order of magnitude of yields. Differences caused by sowing date were not significant, but differences caused by manuring were significant.

(e) *Standard Varietal Test at Barakat.*—The growth in this plot was vigorous and even, and results should be dependable.

Variety.	Yield, kantars per feddan of Lint.	Ginning Outturn.
X1730A	7.48	34.0
X1530A	6.82	33.0
X04729	4.93	29.7
X730	5.49	33.3
Lecrem	4.97	31.3
Gezira Main Crop (Egyptian Sakel) ...	4.59	31.4

(f) *Comparative Inspection Plots in the Gezira.*—The table below gives the average yields of 5 plots at two spacings in widely scattered localities in the Gezira area. The results support the Varietal Test yields. There was no reason to suppose that any variety was peculiarly unsuited to any particular locality.

Variety	Spacing cms.	Yield in k.p.f. (Seed Cotton)	Percentage of narrow Spaced X1530A
X1530A	30	7.215	100%
X1730A	30	7.143	99%
X1530A	60	6.745	94%
X1730A	60	6.237	87%
X1530A	30	7.333	100%
X04729	30	6.496	89%
X1530A	60	7.290	99%
X04729	60	5.572	76%
X1530A	30	7.577	100%
X730	30	6.706	89%
X1530A	60	6.937	92%
X730	60	6.501	86%

(g) *Inspection Plots, Shambat and Gezira Research Farm.*—The types grown included two new importations from Egypt—"Giza 24" and "Giza 25." Neither type seems likely to compete with types already in the country.

(2). *American Types.*

(a) *Line Test at Shambat.*—Nine varieties were tested, different varieties being used as "control" lines, corresponding to the varieties being tested. Pump Scheme Strain, for example, was tested against

514A, a selection from P.S.S. In addition, XA1129 was tested against itself as control, in order to provide a check on accuracy.

The following table gives the results. (The failure of Zeidab Webber, when tested against XA1129, was not confirmed in the Shendi Varietal Test where the two types, under very bad bollworm attack, gave approximately the same yields).

Variety.	Control.	Percentage increase or decrease of Variety over Control.
NT6/34 (Columbia type)	XA1129	- 6%
NT7/34 (Parnell's U4 Selection)	XA1129	+ 2%
514B	514A	- 9%
Pump Scheme Strain	514A	-23%
513B	513	- 1%
513A	513	+15%
511B	511A	+17%
XA1129	XA1129 (Check)	+ 3%
511A	XA1129	-29%
Zeidab Webber	XA1129	-59%

(b) *Inspection Plots and Inspection Lines.*

Kadugli (Nuba Mountains).—One feddan of “513” was grown, to obtain a commercial sample of lint for spinning and grading. The yield was 3·55 large k.p.f.

Kagelu (Mongalla).—Three small plots of XA129 were sown at different dates, namely April 11th, May 10th and September 20th.

In addition, a number of Inspection Lines of different varieties were sown on 10th July at this place between control lines of XA129. An attack of *Helopeltis* sp* practically destroyed all these experimental cottons, the September-sown XA129 plot alone making a crop.

A small plot of X04729, sown 19th September, 1934, yielded at the rate of 440 rotls. per feddan. The grade was low.

STANDARD VARIETAL TESTS (AMERICAN VARIETIES)

(i) *Nuba Mountains Varietal Tests.*—The tables below give the results of tests at Kadugli and Talodi. Rains were short at sowing time and much re-sowing was required. The stands per bed also varied considerably. The columns of “corrected” yields are considered to represent more exactly the varietal comparisons, as eliminating some of the “accidental” variability due to the above causes. In no case, however, are the differences significant. The uncorrected yields were taken for the statistical analysis.

* The actual bug was not found at Kagelu until the 1935 season, but the symptoms on the plant corresponded with sufficient exactness to the description of the damage done by this insect in the Belgian Congo, for there to be no doubt the damage done was caused by *Helopeltis*.

TABLE OF YIELDS FROM VARIETAL TESTS, 1934/35 SEASON.

*American Types.**At Kadugli.*

STANDARD VARIETAL TESTS, KADUGLI.

Variety.	Seed Cotton in Large Kantars per feddan.		Lint in Small Kantars per feddan.		G.O.T. %
	Corrected for Stand and Resowing.	Before Correction.	Corrected for Stand and Resowing.	Before Correction	
514A	4.50	4.56	4.39	4.44	30.9
513	4.60	5.07	4.11	4.52	28.3
P.S. Strain	4.74	4.74	4.41	4.41	29.5
XA1129	4.50	4.77	4.40	4.66	31.0
Acc. Ug. S.G.29	4.55	4.90	4.05	4.35	28.2
511A (Belts)		5.14		4.73	29.2

NOTE.—There are no significant differences between varieties.

Analysis of variance was made on yield figures before correction.

At Talodi.

STANDARD VARIETAL TEST, TALODI.

Variety.	Seed Cotton in Large Kantars per feddan.		Lint in Small Kantars per feddan.		G.O.T. %
	Corrected for Stand and Resowing.	Before Correction.	Corrected for Stand Resowing.	Before Correction	
514A	2.62	2.56	2.50	2.45	30.3
513	2.39	2.61	2.15	2.35	28.5
P.S. Strain	2.65	2.65	2.40	2.40	28.8
XA1129	2.41	2.49	2.27	2.34	29.8
Acc. Ug. S.G.29	2.76	3.00	2.41	2.62	27.7
511A (Belts)		2.71		2.48	29.0

NOTE.—There are no significant differences between varieties.

(ii) *Mongalla Province.*—The tables below give the results of tests at Opari, Kerripi and Maridi. It was necessary to correct the Kerripi yields for stand, but no correction was necessary at Opari. The analysis of the Maridi yields is not yet complete, and unchecked seed cotton weights only are given in that case.

At Kerripi.

STANDARD VARIETAL TEST, KERRIPI.

Variety.	Seed Cotton in Large Kantars per feddan.		Lint in Small Kantars per feddan.		G.O.T. %
	Corrected for Stand.	Before Correction.	Corrected for Stand.	Before Correction.	
XA129	3.09	3.18	3.03	3.12	31.1
513	2.48	2.56	2.19	2.26	28.0
511A	3.28	3.22	2.95	2.90	28.5
Acc. Ug. S.G.29	2.63	2.65	2.27	2.29	27.4
P.S. Strain	2.50	2.50	2.27	2.27	28.8
514A (Belts)		2.40		2.27	30.0

XA129 is significantly better than Acc. Ug. S.G. 29, P.S.S. and 513.

511A is significantly better than Acc. Ug. S.G. 29, P.S.S. and 513.

The difference between XA129 and 511A is not significant.

At Opari.

STANDARD VARIETAL TEST, OPARI.

Variety	Seed Cotton in Large Kantars per feddan.	Lint in Small Kantars per feddan.	G.O.T. %
XA129	1.82	1.88	32.8
513	1.85	1.73	29.8
511A	2.17	2.06	30.1
Acc. Ug. S.G.29	1.85	1.73	29.7
P.S. Strain	2.07	1.97	30.1
514A (Belts)	1.21	1.17	30.6

There are no significant differences between varieties.

At Maridi.

STANDARD VARIETAL TEST, MARIDI.

Variety.										Yield of Seed Cotton in big k.p.f.	
XA129	...	...	...	...	...	...	...	...	...	2.79	
513	...	...	...	...	...	...	...	...	...	2.40	
511A	...	...	...	...	...	...	...	...	...	3.13	
Acc. Ug. S.G.29	...	...	...	...	...	...	...	...	...	2.12	
P.S. Strain	...	...	...	...	...	...	...	...	...	2.41	
514A (Belts)	...	...	...	...	...	...	...	...	...	2.82	

(Unchecked Seed Cotton weights.)

(iii) *Berber Province Varietal Test.*—The table below gives the yields from the Standard Varietal Test on the Gandeto Pump Scheme, near Shendi.

Pink bollworm attack was severe, which accounts for the low yields of all varieties except "513." The achievement of this early maturing strain under these circumstances is decidedly remarkable. The first picking alone gave a greater weight of seed cotton (and lint) than the total of all four pickings of any other variety.

The Egyptian types, grown in the belt beds, made very good vegetative growth, but, owing to their late maturity, the Pink bollworm attack left very few pickable bolls. They also suffered much more severely from Blackarm than the American types.

At Shendi.

STANDARD VARIETAL TEST, GANDETO PUMP SCHEME.

Variety		Seed Cotton in Large kantars per feddan	Lint in Small kantars per feddan	G.O.T. %
514A	Normal-spaced...	2.36	1.86	25.0
513	Normal-spaced...	5.57	4.35	24.8
Zledab	Webber Close-spaced ...	1.87	1.45	24.6
XA1129	Normal-spaced...	1.71	1.40	25.9
XA1129	Close-spaced ...	1.92	1.60	26.5
XI530A (Belt)	...	0.11	0.11	31.8
Giza 7 (Belt)	...	0.49	0.42	27.5

513 is significantly better than 514A, XA1129, close or normal-spaced, and Webber. No other differences were significant.

MISCELLANEOUS EXPERIMENTS ON COTTON AT SHAMBAT.

The Observation Plot, Standard Drum Experiment, and Root Development Studies were carried on as in previous years. An attempt was made to obtain samples of uniform lint for the Shirley Institute.

Another "Seed Increase Ratio" experiment was tried. Sowing 1 seed per hole at a spacing of 180 cms. $\times$ 180 cms., a 700-fold increase was obtained. At normal spacing (90 cms. $\times$ 45 cms.) and 8 seeds per hole, the increase was nearly forty-fold.

GRADING AND SPINNING TESTS.

Acknowledgments are due to Messrs. Wolstenholme and Holland, and the British Cotton Industry Research Association for their courtesy in carrying out these tests.

I. *Egyptian Types*.—In examining the results of these tests, the main interest centres in the comparative usability of the new types as substitutes for the present Main Crop type. The X1530A and X1730A types, at both 100's and 120's counts give yarns which are classed "very good" in appearance; the strength of these yarns are similar; at Barakat they are rather better than Gezira Main Crop Sakel, and in the Varietal Test at the Gezira Research Farm they are somewhat worse. It seems certain, however, that they can be used instead of Gezira Main Crop Sakel in those counts without difficulty.

The Gash Sakel Types (NT2/33 and NT9/34) give stronger yarns and are graded considerably higher than most of the other types, but, rather inexplicably, do not give such a good yarn appearance. *Lecrem* at Barakat, though it bears a marked similarity to Gezira Main Crop Sakel in fibre characters, spins an appreciably stronger yarn, though the difference in its favour does not appear to be so marked as last year.

II. *American Types*.—In the Nuba Mountains (Kadugli) the spinning qualities of 514A and XA1129 were a little superior to those of Pump Scheme Strain, while 513 was inferior. The samples from this place gave the strongest yarns. At Shendi, 514A gave the strongest sample with XA1129 second, and 513 and Webber were very similar to each other and the weakest of four types tested.

Kerripi samples were, with the exception of XA129, generally weaker than the Kadugli samples. XA129 had the shortest "effective length" of any American sample, yet gave a surprisingly strong yarn.

The grading tests show that all the samples would be considered as "long staple Americans" (with the possible exceptions of XA129 and 513 at Kerripi).

At the highest counts tested (64's) XA1129 from Kadugli gave the strongest yarns. This accords with the results of previous years' tests.

Generalizing on the results of this year's tests, it can be safely said that, with the exception of 513, the new types should be able to replace existing commercial types with very little dislocation. The 513 type depends on its exceptional agricultural qualities for its continued existence.

(Included by courtesy of the Uganda Government.)

UGANDA

COTTON EXPERIMENT STATIONS, BUKALASA AND SERERE. PROGRESS REPORTS FOR THE SEASON 1934-35

BUKALASA ZONE.

BY

G. W. NYE AND J. D. JAMESON.

METEOROLOGY.

Owing to late rains the season was abnormally late. Rains were normal, however, during the growing season, and the picking season was dry. Consequently there was a heavy crop of high grade cotton, but owing to the short growth period staple was irregular. No hail damage was sustained at Bukalasa.

COTTON.

BREEDING PLOT.

New Selections. Several selections from local cotton were grown and gave promising results. B.180 was resistant to Blackarm ; B.274 had very remarkable vertical monopodia, but was susceptible to Blackarm. Re-selections from B.31 were disappointing as they appeared to be losing resistance to Blackarm. Only one U.4/4/2 derivative had satisfactory lint. U.955 and U.998, obtained from Mr. Parnell at Barberton, were grown for the first time.

Pedigree Lines. These were in two main groups : B.P.50 (ex B.37 and Buganda Local) group, and S.G.23/8 (ex Nyasaland Upland) group. The lines from B.P.50 all showed improvement in uniformity ; but the lint, though still good, was not further improved ; and unfortunately most strains were heterozygous for Blackarm resistance. One strain had to be set aside on account of susceptibility to Fusarium Wilt. The S.G.23/8 group was remarkable for low boll-shedding rates ; yield was satisfactory and resistance to Blackarm showed improvement over the parent strains ; unfortunately negative correlation between lint length and ginning outturn was very marked, and a satisfactory combination of the two characters was not obtained. Another pedigree, B.P.89 (ex B.42 and Buganda Local), gave a good yield and

had promising lint characters in spite of severe Blackarm attack. Lines derived from U.4/4/2 did well, but failed to give the requisite lint characters.

Hybridization. This was undertaken for the first time on broad lines using Nyasaland Upland, Buganda Local and U.4 strains. Eleven F_1 strains were obtained.

Trinidad Hybrids. Re-selections were grown, but all of them were practically worthless on account of short lint. Further re-selections were made for re-trial.

Fusarium Wilt Plot. A plot was artificially infected with *Fusarium Wilt* by digging in infected material and planted up with bulked seed of several strains. 20% of the plants contracted the disease, but of these only 10% displayed symptoms externally. The remainder showed typical internal discoloration of the stem. The seed supply will be carried on from year to year with a view to obtaining resistant strains by mass selection.

INCREASE PLOTS.

(a) *Small Bulk.* A quarter-acre was planted with B.P.58 (ex S.G. 23/8 and Nyasaland Upland). This strain was the highest yielder in the variety trial, and the yield from the quarter-acre was excellent. The lint, however, was short and harsh, and increase is proceeding no further at present.

(b) *Medium Bulk.* One-and-a-third acres were planted with B.P.50 (ex B.37 and Buganda Local). The stand was poor owing to limited seed supply. 25% of the plants were rogued out for susceptibility to Blackarm and later experience has shown that the plants retained were heterozygous for this character. Taking the reduced stand into consideration, the yield was excellent. The crop was ginned commercially and gave 31.6% ginning out-turn. The staple was full $1\frac{3}{16}$ ins. The habit of the plants was also very commendable. The variety is now in the main bulk area.

(c) *Main Bulk.* Sixteen acres were planted with S.G.23/8 in order to obtain a large lint bulk for a commercial sample. The yield was moderate.

VARIETY TRIALS.

At Bukalasa an 8×8 Latin Square was planted using the standard 4 feet $\times$ $1\frac{1}{2}$ feet spacing. The varieties were as follows :—

Buganda Local (Control).	
B.P.49 (ex B.31 and Buganda Local).	\
B.P.50 (ex B.37 " " " ")	.
B.P.52 (ex B.42 " " " ")	.
B.P.56 (ex B.45 " " " ")	.
S.G.23/8 (ex Nyasaland Upland : selected at Serere in 1924).	
B.P.58 (ex S.G.23/8).	
B.P.59 (ex S.G.23/8).	

Germination was excellent and no varietal differences were revealed. B.P.50 had good erect habit, and B.P.52 was also erect. B.P.56 was a single stem type which matured early. B.P.49 was squat. B.P.58 was similar in habit to S.G.23/8, but B.P.59 was poor.

All varieties proved to be more susceptible to Blackarm disease than Buganda Local, except that statistical significance was not reached in the case of B.P.56 and B.P.59. B.P.49, which should have been resistant, was severely attacked and gave the lowest yield. B.P.52 was the most severely attacked of all, but yielded tolerably well; it is the parent of B.P.89 mentioned under "Pedigree Lines" above.

B.P.56 and B.P.52 set the half of their crops three weeks and a fortnight respectively in advance of Buganda Local. B.P.56 gave a lower yield than Local, however, and probably failed by not having many monopodia on which to set a late crop.

The mean yield of seed-cotton was over 1,000 lbs. per acre, and one variety, B.P.58, yielded exactly one bale (400 lbs.) of lint per acre. B.P.49 was by far the worst yielder, and B.P.56 was also relatively poor.

All other varieties, broadly speaking, were equivalent to Buganda Local. B.P.58 gave a better yield of seed-cotton than its ancestor, S.G.23/8; but as S.G.23/8 was the only variety with a relatively good ginning out-turn (31.6%), this difference was not revealed by the lint yields.

Lint samples were submitted to local buyers who placed B.P.50 easily first, B.P.52 second, and S.G.23/8 third. B.P.50 is long-stapled, silky, strong and uniform, and represents a considerable advance over Buganda Local.

District variety trials were conducted at various centres. The lay-out consisted of five randomised blocks at each centre; the varieties Buganda Local and S.G.23/8 were included at all centres, and in addition B.31 (ex Buganda Local) was included at one centre and B.37 (ex Buganda Local and parent of B.P.50) was included at two others. Blackarm observations were made, but only gave one result; in that instance S.G.23/8 was found to be more susceptible than Buganda Local. Buganda Local yielded (seed-cotton) better than B.37 and S.G.23/8 in one trial and better than S.G.23/8 in another; it also yielded better than S.G.23/8 in a combined analysis of all centres from which results were obtained. The yield of S.G.23/8 is compensated to some extent by a higher ginning out-turn.

Variety trials comprising Bukalasa varieties were also in four centres in Busoga district. The lay-out was a 4×4 Latin Square at each centre, consisting of the varieties Buganda Local, S.G.23/8, B.31

and S.G.29 (from Serere). Blackarm counts showed S.G.29 to be the most susceptible variety, the other varieties being equivalent to Buganda Local. B.31 yielded (seed-cotton) better than all other varieties at one centre and better than S.G.29 in a combined analysis of all centres. Buganda Local also verged upon a significant superiority over S.G.29. B.31 proved far more successful in these trials than it ever has done at Bukalasa.

SPINNING TESTS AND BROKERS' REPORTS (1933-34 CROP).

Samples of the following varieties were submitted to the Empire Cotton Growing Corporation :—

Buganda Local.
 B.31 (ex Buganda Local : resistant to Blackarm).
 B.P.28 (ex B.42 and Buganda Local : early maturing).
 S.G.23/8 (ex Nyasaland Upland).

The Brokers' reports were favourable and the spinning test reports unfavourable on B.31 and B.P.28 and contrariwise the Brokers' reports were unfavourable and the spinning test reports most favourable on S.G.23/8. The outstanding result, however, is that the spinning test reports continue to show that S.G.23/8 is a very excellent spinning cotton ; the highest standard count being assessed at 85 to 87 as against Buganda Local 49 to 51.

A series of samples of Buganda Local and S.G.23/8 from various variety trial centres was submitted to the Indian Central Cotton Committee. The Spinners' report is most favourable to S.G.23/8, confirming that received from the Empire Cotton Growing Corporation. The Indian Brokers' report is not so favourable to S.G.23/8, but at the same time does not present the anomaly shown by the Liverpool Brokers' reports.

SEED FARM FOR BUGANDA.

With the expected production of improved cottons at Bukalasa the necessity for a seed farm and seed distribution scheme arises. The whole question is receiving careful attention and financial assistance is being given by the Empire Cotton Growing Corporation. The largest acreage which can be safely segregated at Bukalasa is 18 acres and the suggested seed farm stages subsequent to Bukalasa are 60 acres at Kawanda Plantation, which has recently been acquired by Government, followed by 500-600 acres comprising all the cotton grown in one gombolola of Entebbe District, which consists of the Entebbe Peninsula. This area, although not high-yielding, is comparatively easily segregated and the fact that it is on the Lake and near Kampala makes it an economical centre for later stages of distribution. A careful survey of the agriculture of Entebbe Peninsula is being carried out so that full details will be known before the area is actually used.

CULTURAL EXPERIMENTS.

The various cultural experiments at Bukalasa are being continued and last season's results are summarised below :—

Spacing. 3 feet×1 foot spacing gave a higher yield than the standard 4 feet×1½ feet, confirming previous season's results.

Green Manure Experiment. This experiment has been started in order to ascertain the optimum period that a green manure should be dug in before the subsequent cotton crop. *Crotalaria juncea* was grown and dug in at fortnightly intervals, the sowings being so arranged that the *Crotalaria* was at the same stage of growth when it was dug in. On a given date the whole area was planted with cotton. The treatments were as follows :—

- (1) Control. No green manure.
- (2) Green manure dug in 2 weeks prior to cotton planting.
- (3) " " " 4 " " " "
- (4) " " " 6 " " " "
- (5) " " " 8 " " " "

Digging-in 4 weeks before cotton planting was the only treatment to give a significant increase in the yield of cotton. Digging-in two weeks before planting had a slight, though not significant, depressing effect.

Interplanting. The experiment to test the effect and economic value of interplanting cotton with beans or groundnuts, a common native practice, was continued on modified lines. The interplanted crops were sown in one or two rows between the cotton immediately after the cotton had been thinned, following local practice. Apart from the increased cash return from the groundnuts, interplanting actually increased the yield of cotton.

Mulching. The effect of mulching late-sown cotton with elephant grass was again tested, but with only a 3-inch mulch instead of 6 inches as used in the previous year. The result still showed a significant increase in the yield of cotton due to the mulch, and in addition the increased yield more than balances the cost of mulching, a result which is not obtained with a 6-inch mulch owing to the high cost of application.

Manurial Experiment. The experiment detailed in last year's report was continued in order to test the residual value of the manures (cotton seed, green manure, and a combination of cotton seed and green manure). The results showed that the cotton seed had a considerable residual effect on the early-sown groundnut crop, but no residual effect at all was found on the later sown cotton. The manurial treatments will be repeated in 1935–36 season.

Rotations. Various rotation experiments are being carried out, but it is too early for the publication of results. One of the most

important of these is the testing of the value of resting periods varying from one to five years under a cover of planted elephant grass.

LOCAL PROPAGANDA.

A scheme whereby intensive propaganda is being carried out in the villages close to Bukalasa has been initiated, since it is considered that natives cultivating near to a Government Experiment Station should show a higher standard of cultivation than those further away, and that by example an ever-increasing circle of improved cultivation can be obtained. The work has started with a team of 25 or so selected cultivators who have expressed their willingness to follow departmental advice. In the season under review special attention was paid to anti-erosion measures, improved spacing of cotton, proper planting and pruning of coffee and better cultivation of plantain gardens. The response to this work is encouraging and it appears to be well worth while proceeding with and extending it.

DISEASES AND INSECT PESTS.

Blackarm was more in evidence than usual at Bukalasa, but a remarkable recovery was made, especially in the large plot of S.G.23/8.

Wilt. Although less in evidence at Bukalasa than last year a bad patch occurred in the Breeding Plot and many diseased plants were observed in native plots. It is obvious that breeding for wilt resistance is necessary and it adds one more to the many problems confronting the cotton breeder in Uganda.

Pink Bollworm was reported late in the season at Bukalasa for the first time, in the plot of S.G.23/8. Little damage was done.

Lygus. This pest threatens to be very serious at Bukalasa early in season, but plants made a remarkable recovery. No varietal differences in the severity of attack were observed.

Spiny Bollworm was, as usual, prevalent and did considerable damage. As buds, flowers, bolls and main shoots are severely damaged by this pest, an investigation of its effect is called for.

Jassids, although present, were responsible for no damage.

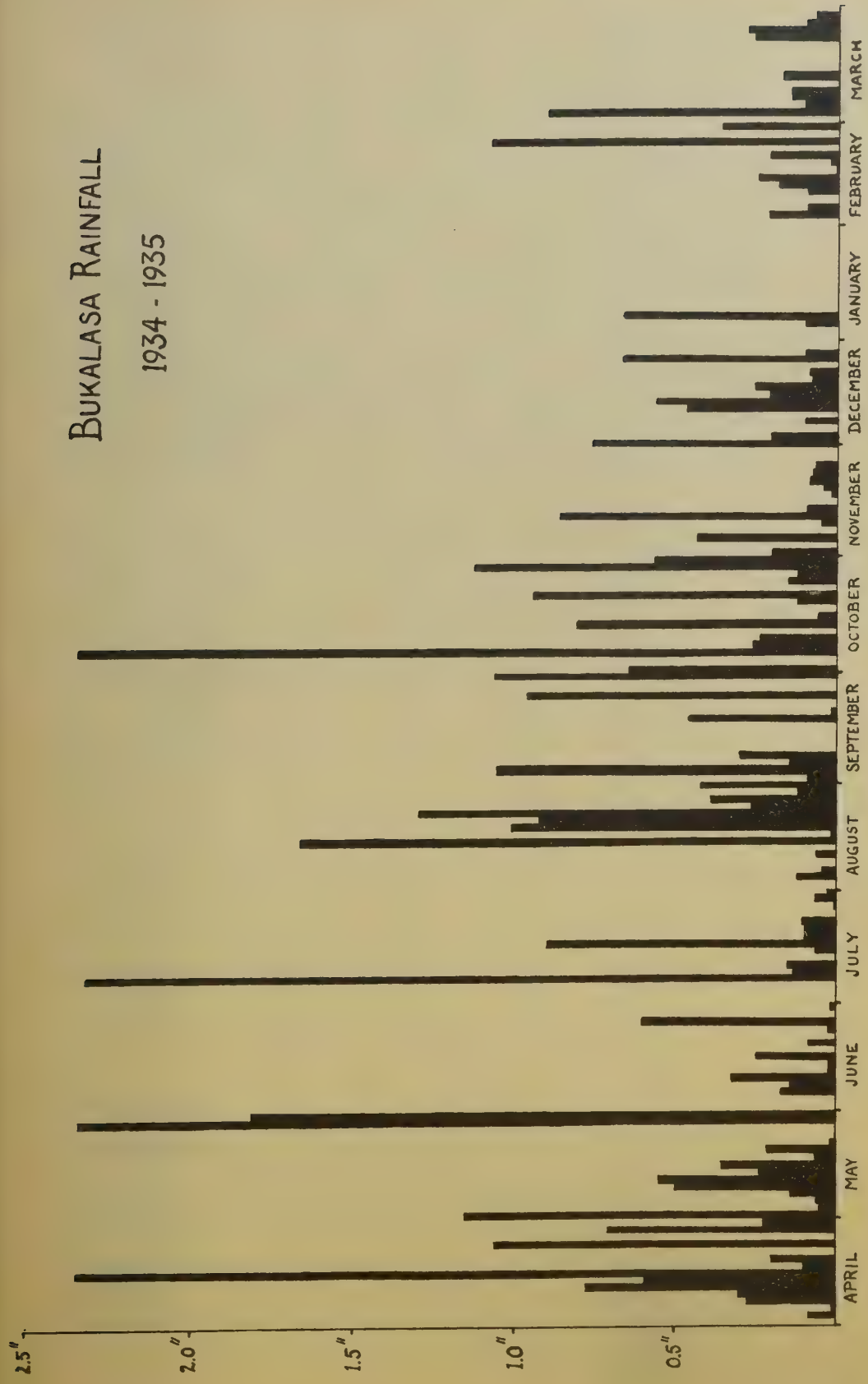
Helopeltis. Damage was negligible and *stainers*, although prevalent enough on a plot of early-sown cotton to warrant hand picking, were not present in sufficient numbers to damage the crop severely.

Syagrus was not observed at Bukalasa this season.

Acknowledgments for valuable assistance are due to the Indian Central Cotton Committee, the Empire Cotton Growing Corporation, the British Cotton Industry Research Association, Messrs. Wolstenholme and Holland, Messrs. The Liverpool Uganda Co., and Messrs. Narandas Rajaram & Co.

BUKALASA RAINFALL

1934 - 1935



SERERE ZONE.

BY

H. R. HOSKING.

METEOROLOGY

Weather conditions at Serere and in most of the area east of the Nile, with the exception of the more northerly parts, were generally unfavourable for cotton.

At Serere the total rainfall for 1934 was more than 8 inches below the thirteen-year mean. Moreover, the distribution was irregular and resulted in the optimum sowing date being later than usual.

The grade of the cotton purchased was not as good as in the previous season, owing to rain at the commencement and finish of the picking period.

SERERE 1934/35 WEATHER CONDITIONS.

<i>Month.</i>	<i>Rainfall.</i>	<i>Sunshine.</i>	<i>Air temperatures.</i>	<i>Remarks.</i>
1934.				
April ...	Just below average.	Average.	Above average.	Rather hotter and drier than usual.
May ...	Nearly 1½ inches below average.	Above average.	Below average.	Second half of the month unsuitable for successful cotton planting.
June ...	Just below average.	Much above average.	Below average.	First half of month dry, second half suitable for cotton planting.
July ...	Nearly 3½ inches above average.	Average.	Much below average.	Very wet and cold—good planting weather but brought on heavy infection of Blackarm on April and early May plantings. Very good for late June plantings.
August ...	Below average.	Much below average.	Much below average.	Drier than usual, but temperatures low and weather cloudy, this increased blackarm.
September	Very much below average.	Much above average.	Much above average.	Dry and hot—Checked blackarm and also tended to check growth.
October ...	Well below average.	Above average.	Much above average.	do.
November	Below average.	About average.	Just below average.	Blackarm increased during wet period Oct. 27—Nov. 11th. Remainder of Nov. dry.
December	Above average.	Just below average.	Just below average.	Rain caused damage to ripening cotton.
1935.				
January ...	No rain.	Above average.	Much above average.	Ideal cotton ripening weather—grade improved.
February ...	Above average.	Below average.	Below average.	Rain damaged the final part of the crop.
March ...	Much below average.	Much above average.	Very much above average.	Cotton buying finished at month end.

COTTON.

BREEDING WORK.

As in previous seasons, the selections were divided into two groups consisting of Pedigree Lines and New Selections. One hundred plants each of ten Pedigree Lines, and twenty-five plants each of two hundred and nineteen New Selections were planted. The latter included eighty-one selections from Trinidad hybrids. All rows which developed Blackarm disease badly were rigidly discarded. Despite a very heavy infection of Blackarm on the control rows of S.G.29 many of the strains showed marked tolerance to this disease. In November the control

rows of S.G.29 averaged nearly three lesions per plant, while only seven out of approximately 950 in the Pedigree Lines carried lesions.

For the first time local brokers classed the lint of the later U.4/4/2 derivatives as being better than S.G.29. The two strains S.P.84 and S.P.87 are particularly promising in this respect. S.P.89, a probable hybrid between U.4/4/2 and S.G.29, is still splitting badly for ginning percentage, Blackarm resistance and lint length, but carries very nice lint. The strain cannot be increased in its present state, but re-selection may result in uniformity.

S.P.88, derived from a Nariama selection, also gave lint classed superior to S.G.29 by local brokers. The yield is still low and further re-selection will have to be made.

There seems to be every hope that we shall soon be in a position to replace S.G.29 with one of the U.4/4/2 derivatives, without losing very much in lint quality. This is extremely satisfactory, as these cottons give considerably higher yields and better ginning percentages than S.G.29.

CULTURAL EXPERIMENTS.

1. *Combined Variety, Dusting and Sowing Date Trial—Serere.* This was a very large experiment of the complex type. The lay-out was decided upon after reference to the authorities at Rothamsted. It consisted of 288 plots layed out as a 4×4 Latin Square for Sowing Dates. Each sowing date "cell" of the Latin Square was divided into 3 strips of 6 plots each. Each strip received either no seed dust, or dust Abavit B, or dust 413a at random.

The six plots of each strip were allotted to the six varieties at random.

Treatments :—

Sowing Dates.	April 24th.	Varieties.	S.G.29—Control.
	May 15th.		S.P.1.
	June 12th.		S.P.20.
	July 16th.		S.P.21.
			S.P.48.
Seed Treatments.	Control—no dust.		S.P.72.
	Dust 413a.		
	Dust Abavit B.		

Results :

(a) Varieties.

S.P.48 gave a higher yield than all other varieties.

S.P.20 and S.P.21 gave similar yields and both were significantly better than S.P.1, S.P.72 and S.G.29.

S.P.1 gave a significantly higher yield than S.P.72 and S.G.29.

S.G.29 and S.P.72 gave similar yields.

(b) Sowing Dates.

June proved to be the optimum sowing date for that season.

(c) Interaction of Sowing Date $\times$ Seed Treatment.

No difference between seed treatments in April, May and July ; but in June both dusts significantly increased yield.

(d) Interaction of Variety $\times$ Sowing Date.

S.P.48 appears to be more tolerant to late planting than S.G.29 (control).

S.P.72 gave lower yields as the sowing date became later.

In general the U.4/4/2 derivatives (S.P.1, S.P.20, S.P.21 and S.P.48) can stand later planting better than either S.G.29 or S.P.72. The two latter varieties are derived from Nyasaland Upland.

The experiment as a whole proved to be extremely satisfactory, the standard error of a single plot being approximately 1% of the general mean, and differences between varieties amounting to only 7.1% of the general mean were shown to be significant. Owing to the success of this large trial an experiment of similar size, substituting three spacings for the seed treatments, will be conducted next season.

2. *Miniature Variety Trial—Serere.*

This experiment consisted of 136 one-row "plots" of seventeen varieties, replicated eight times in random blocks. Each "plot" consisted of one row of fifty plants at a spacing of one foot in the row, and three feet between the rows or "plots." In this manner it was possible to test a number of promising strains of which insufficient seed was available for inclusion in large trials.

The experiment was a distinct success, as it demonstrated statistically differences between varieties for infection of angular leaf spot, number of Blackarm lesions per plant, and final yield of seed-cotton.

The outstanding results were :

- (a) N.17 (the old control variety) gave a significantly higher yield and fewer Blackarm lesions than S.G.29 (present control).
- (b) All selections showed a considerably lower Blackarm infection than either N.17 or S.G.29.
- (c) The more recent U.4/4/2 derivatives gave particularly high yields.

3. *District Variety Trials.*

As in previous seasons, 4×4 Latin Squares of the same four varieties were laid down at eleven centres scattered over the area east of the Nile.

Results :

- (a) Total yields.
The varieties S.P.20, S.P.1 and N.17 gave yields 43.9%, 32.8% and 22.2% respectively better than S.G.29.
- (b) Lint yields. Owing to the high ginning percentages of S.P.20 and S.P.1 the above differences were accentuated after ginning. The relative yields were S.P.20, 175.5% ; S.P.1, 159.9% ; N.17, 117.4% and S.G.29, 100%. Over the whole eleven trials S.P.20 averaged 263 lbs. of lint per acre as compared with S.G.29's 150 lbs. lint per acre.
- (c) The Interaction of Variety $\times$ Centre was highly significant because S.P.20 and S.P.1 gave higher yields relative to N.17 and S.G.29 in Lango, Teso, Bugwere and Budama than in the more fertile Busoga.

In addition to the above trials a small variety trial was carried out by the Agricultural Officer, Teso, at Katakwi in North Teso. The two strains S.P.36 and S.P.72, originating from a selection made at Nariama

in North Teso in 1929, gave significantly better yields than S.G.29. S.P.20 and S.P.13 gave better yields than the Nyasaland varieties, including the two Nariama strains.

4. Cotton Sowing Date and Spacing Trial—Serere.

A similar experiment has been carried out for the two seasons 1933/34 and 1934/35. The treatments were three spacings combined with three sowing dates. The lay-out took the form of a duplicated 3×3 Latin Square for Sowing Dates, each sowing date plot being divided at random into three spacing sub-plots.

Treatments :—

Sowing Dates.	May.	Spacings.	3' × 1'.
	June.		3' × ½'.
	July.		3' × ¼'.

Results :

(a) 1934/35 season only.

No difference between sowing dates or spacings, but the interaction between these two factors was highly significant, because in May the three spacings gave similar yields; in June, $3' \times 1'$ gave a better yield than $3' \times \frac{1}{2}'$ or $3' \times \frac{1}{4}'$; while in July $3' \times \frac{1}{4}'$ and $3' \times \frac{1}{2}'$ gave a better yield than $3' \times 1'$. i.e., closer spacing gave better yields with late sowing date.

(b) Combining 1933/34 and 1934/35 Seasons.

No difference between sowing dates.

$3' \times 1'$ and $3' \times \frac{1}{2}'$ spacings gave significantly better yields than $3' \times \frac{1}{4}'$.

Interaction season $\times$ sowing date very significant because in 1933/34 the early sowings gave the best yields, while in 1934/35 the late sowings were the most successful.

Interaction of spacings $\times$ sowing dates was significant because $3' \times 1'$ gave the highest yields in May and June; while $3' \times \frac{1}{2}'$ gave the best yield in July.

5. Manurial Experiment—Serere.

This experiment was commenced in 1933. It is a 5×5 Latin Square with the following treatments :—

A. Control—Green manure only.

B. Green manure preceded by lime 2 tons per acre.

C. " " farmyard manure 10 tons per acre.

D. " " " 20 " "

E. " " " 30 " "

The manuring was done in the spring of 1933, and the following rotation has been followed on all plots.

1933. Green manure plus treatment, except for control plots which received green manure only. Followed by cotton.

1934. Cotton uprooted, then *Elusine coracana* (wimbi or finger millet). This was followed by late cotton.

1935. Cotton uprooted, early groundnuts followed by green manure.

Results :

(a) 1933 Cotton. Variety S.G.29.

No difference in yield between any of the treatments.

(b) 1934 *Elusine coracana*.

No difference in yield between any of the treatments.

(c) 1935 Cotton. Variety U.4.4

The three farmyard manure treatments gave similar yields and were significantly higher than both Control and Lime. Lime appears to be depressing the yield but so far the difference is not significant.

(d) 1935 Groundnuts. Bunch Variety.

Large differences in favour of the dunged plots, but not statistically significant.

(e) Combining the results from 1933 to 1935 on the basis of 10 cents per pound for cotton, 1 cent per pound for unthreshed wimbi, and 4 cents per pound for unshelled ground nuts, then the gross cash return per acre for the five treatments shows that the three farmyard manure treatments have given a significantly greater return than the limed treatment.

The three former treatments also show an increase over Control, but this difference is not statistically significant.

There is no doubt that when the experiment has run another cycle the farmyard manure will show a real increase over Control.

COTTON SEED MULTIPLICATION.

Further distribution of the strain S.G.29 has been discontinued, partly on account of its increasing susceptibility to Blackarm disease. The three Segregated Areas of Mulondo (300 acres), Labori and Kadunguru gombololas (3,600 acres), and Serere and Kasilo sazas (25,800 acres) were planted with S.G.29, but none of the seed was used for distribution to other areas east of the Nile.

The usual small increase plots of the more promising strains were grown at Serere. The Serere 3-acre stage was planted with S.P.20. This strain will go to the 40-acre stage at Serere next year. The Serere 40 acres were planted with S.P.1, and this yielded at the rate of 476 lbs. per acre. The ginning percentage under commercial conditions came out at 34.3%. The seed of this will be planted in the Mulondo Segregated Area next season. It is not intended to increase this strain beyond this stage, but we wish to know whether cotton of this description can be sold easily.

S.P.20, and any subsequent strain, will be an improvement on S.P.1.

SPINNING TESTS.

Samples of S.G.29, S.P.1, S.P.13, S.P.20, S.P.21, and S.P.36 (10 in all) from the 1933/34 crop were tested by the Shirley Institute, Didsbury. The results were not very conclusive. The report stated "the superiority of the S.G.29 samples is not so marked as in last year's tests." The spinning qualities of S.G.29 appear to be deteriorating slightly.

Further samples from the 1933/34 crop were also sent to the Indian Central Cotton Committee for test. The following statement occurs in the report "the spinning performances of S.P.1 and S.P.13 are very nearly the same as those of Buganda Local cotton." Also "The Grader's valuation shows S.G.29 to be superior to, S.P.1 to be equal to, and S.P.13 to be inferior to, Local Buganda cotton."

BROKERS' REPORTS.

A report has been received from the African-Grown Cotton Company Ltd., of Liverpool, on 6 bales of S.P.1 grown at Serere in 1934/35. This Company states " . . . in our opinion small shipments of this quality might not be easy to dispose of satisfactorily on the Liverpool market. On the other hand it is quite probable that if sufficient cotton was marketed to guarantee a continuity of supply the position would be reversed.

" Regarding quality, the grade is high, colour is very good, but the staple length is about good $1\frac{1}{8}$ inches in comparison with full $1\frac{1}{8}$ to $1\frac{3}{16}$ of average Uganda cotton. The fibre, however, to the finger test, is fairly strong and appears free from waste." They quoted a nominal value on Liverpool spot terms of about 75 points on (August 6th, 1935).

Local Brokers kindly classed lint from the Pedigree Lines. The strains S.P.84, S.P.87, S.P.88 and S.P.89 were all classed as superior to S.G.29. These opinions have substantiated the claim put forward in last year's report that "there is a distinct possibility of further improvement of the lint characters of this family (U.4/4/2 derivatives) with continued selection."

This is a gratifying result, particularly as both S.P.84 and S.P.87 (U.4/4/2 derivatives) are high yielders, have marked resistance to Blackarm, and have a considerably higher ginning percentage than S.G.29.

SUMMARY.

Owing to unfavourable weather conditions and severe Blackarm disease, the yields were below average at Serere and in the Eastern Province.

S.G.29, chiefly due to its susceptibility to Blackarm disease, gave a lower yield than N.17. done high

In all variety trials the U.4/4/2 derivatives again gave a much higher yield than either S.G.29 or N.17. For the first time, local Brokers have classed the better U.4/4/2 derivatives above S.G.29. done

With their high resistance to Blackarm disease and drought, and with their high yield, and possibly with lint little, if at all, inferior to S.G.29, there is every prospect of such strains as S.P.87 proving a success in the Eastern Division. Increase of S.P.87 and S.P.84 will be carried out as rapidly as possible.

In a season with severe Blackarm disease, the dusts Abavit B. and 413a. failed to produce an increase of yield over non-dusted seed, except in the June sowings. done

The work done during the past five seasons has resulted in the production of strains which are so highly resistant to Blackarm that dusting becomes unnecessary.

SERERE 1934-35

Inches

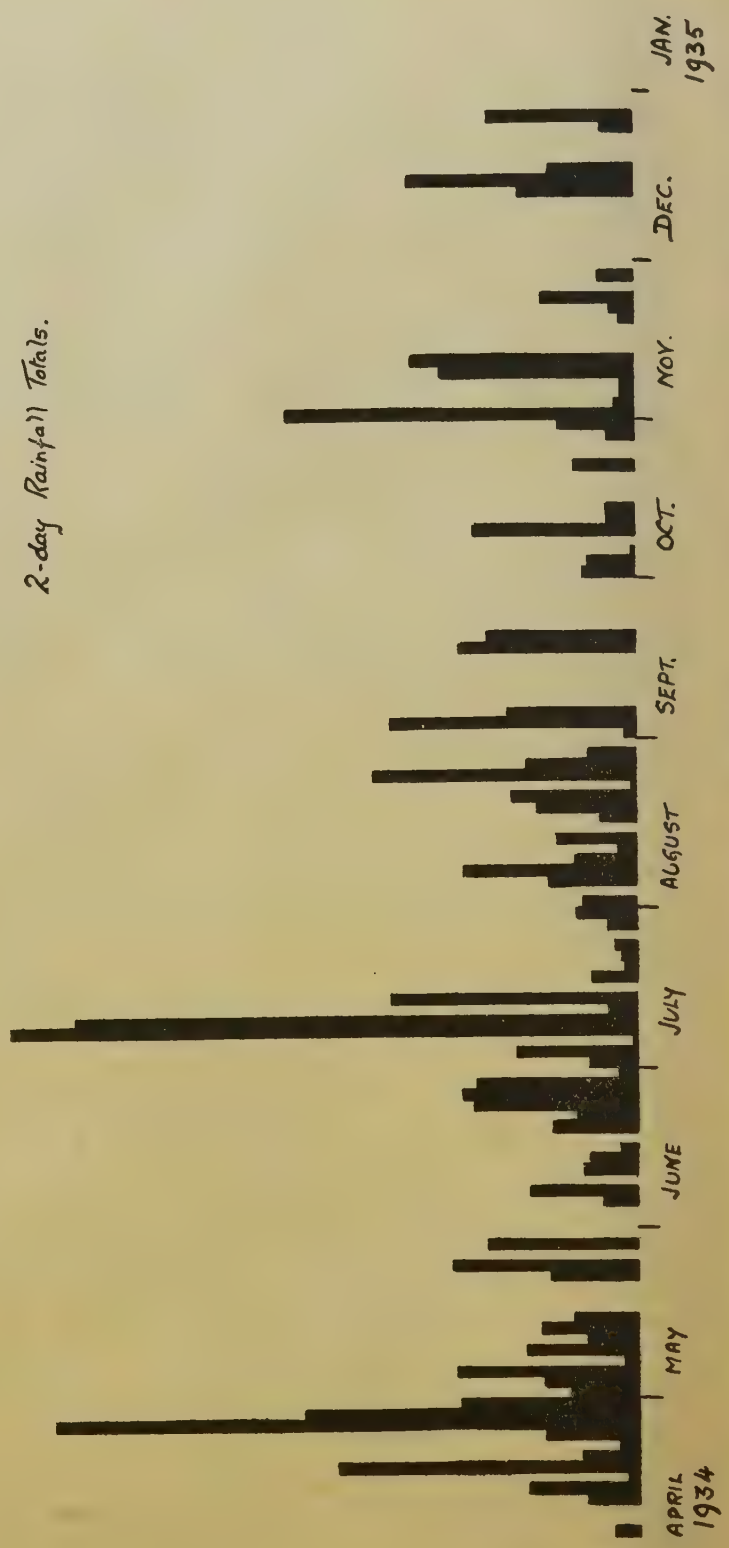
3-

2-

1-

0

2-day Rainfall Totals.



[Included by courtesy of the Tanganyika Government.]

TANGANYIKA TERRITORY.

UKIRIGURU AGRICULTURAL STATION, LAKE PROVINCE,

PROGRESS REPORT FOR THE SEASON 1934-35.

BY
D. THORNTON.

Climatic Conditions.—The general weather conditions were fair, but the rains were abnormally long, extending over a period of eight-and-a-half months, compared with the average of six months. The dry spell between the early rains and the main rains was severe and held up plant growth. Although an excellent season for many crops, cotton on the farm and in the neighbourhood made poor development, the cold, wet weather towards the end of the season resulting in abnormal type of growth of all plants and heavy boll-shedding. Cotton yields were low and the percentage stained was high.

Cotton Work.—The testing of strains was carried out in two strain trials; these made poor development, but although all strains were severely damaged it was possible to compare the selections and five strains of promise were isolated, two of these repeating their good performance of last year. U.4/4/2 from Shinyanga was included in one of the strain trials to compare with the new selections; in yield of seed cotton it was placed sixth out of the fourteen selections.

In a variety trial of local cotton, U.4/4/2 and two mass selected mixtures of Local cotton (Uganda Upland), U.4/4/2 gave the highest yield of 213 lbs. per acre compared with 193 lbs. per acre given by a mass selection from Local cotton, and 184 lbs. per acre given by unselected Local cotton. Unfortunately the differences were not enough to give significance owing to the extreme variation in the trial.

The progeny plots of 1934 field selections were severely attacked by capsid and the resulting structural damage and heavy flower- and boll-shedding which took place so masked the inherent possibilities of the selections that, with the exception of a few which went down to the slight attack of jassid, they are to be tried in the progeny plots for another year.

Insect Pests.—Damage by insect pests of the cotton on the farm and in other areas was severe. This has been found to be due to injury by capsid, and the typical symptoms are strong monopodial growth with abnormal lengthening of the internodes, malformation and piercing of the leaves, resulting in heavy flower-and boll-shedding. Observation in previous years showed the damage to be most severe in cold, wet seasons, and still more intense in low-lying areas. No direct control measures are known, but cultivators were advised to avoid cotton-growing in the heavy valley bottoms.

During the dry spell in January there was a heavy aphid infestation which, although damaging plants, disappeared with the main rains.

A large population of stainers was present and the percentage of stained cotton was high, over 30%, and in a number of cases barely sufficient seed stocks of strains have been obtained for future plantings. Other pests, although present, did comparatively little damage.

Rotation Crops.—Considerable progress was made with other rotational crops as weather conditions were more suited to them.

Sorghums.—Three variety trials in which thirty-five native sorghums were tested have given valuable results. The trials were carried out in order to obtain data on yields, characteristics, resistance to damage by striga and insect and fungoid pests. Certain varieties have proved very superior to the majority. The work of classification and the data obtained have reached a point at which selections within these varieties can now be carried out. Observation work on introduced varieties show that none is of any special merit. Feterita, a three months sorghum from the Sudan, proved a valuable early crop, but a number of characteristics show that it is of limited application.

Millet.—Two trials resulted in proving that the introduced awned bulrush millet is not a superior yielder to the native millet on the lighter soils, but it gave excellent yields on a multiplication plot on heavy black soil and may be more suited for cultivation on such areas. The presence of awns makes it partly resistant to damage by birds, a controlling factor in millet cultivation, but constant selection is required to maintain this characteristic.

Groundnuts.—A trial between the local native mixture of groundnuts, Virginia Bunch, and Manyema, a variety from another district, gave significant results in favour of the local native mixture.

In a second trial in which a Barberton strain was compared with Basse, Philippine White and Mwitunde, a selection from the local mixture of groundnuts, the newly introduced Barberton proved a markedly superior yielder and, in addition, gave very low rosette disease

counts compared with the others. The Barberton strain yielded 932 lbs. per acre of shelled nuts with 76.5 % shelling percentage.

Maize.—Introduced Kenya Hybrid maize gave high yields and has proved suited to local conditions, provided early planting is carried out. Selections from native maize were tried and, although not such good yielders as the introduced Kenya Hybrid, are more suited to native cultivation as planting can be carried out over a wider range of planting dates owing to the shorter period of maturity.

Minor Crops.—The raising of cassava from seedlings in an attempt to obtain strains resistant to mosaic disease gave no result. Trials of various crops, both food and fodder crops, have shown the following to be of definite value :—Dolichos bean as a fodder crop, Tepary bean, a quick maturing food crop, Elephant Grass as a fodder crop, Ironbark pumpkin as cattle feed.

Cultural Experiments.—The maintenance of fertility of native holdings by various treatments in order to allow of a fixed tenure is the basis of most of our agricultural improvements and a number of manurial trials were carried out.

The residual effect of a dressing of 7 tons per acre of kraal manure, dry cattle manure, applied to bulrush millet in 1932 gave this season a significant increase in yield of grain of 31% in favour of the treated plots. The increases in 1932 and 1933 were 33% and 49% respectively in favour of the treatment. Dressings of 3, 6, and 9 tons per acre of kraal manure applied to cotton in 1934 gave no significant increase in yield that year. The residual effect was tested this season with bulrush millet. Significant results were not obtained owing to the seepage from the heavily manured plots, but the 3, 6, and 9 tons per acre treatments yielded respectively 855, 865, and 976 lbs. per acre grain compared with 795 lbs. per acre from the untreated plots.

A trial of three rates of dressing, 2, 5, and 8 tons per acre applied to pennisetum in 1934 gave no significant results that season, due it is thought to the dry state of the soil. The residual effect was tested with cotton and the application at the rate of 8 tons gave a highly significant increase in yield of seed-cotton of 62% over control which yielded 247 lbs. The 2 tons per acre gave an increase at the rate of 36% ; the 5 tons per acre dressing gave an increase of 18% but this was not sufficient for significance.

Properly made farmyard manure was available for the first time this season and dressings of 1, 3 and 5 tons per acre applied to millet were tried. Significant increases in yield were obtained. These did not progress in ratio to the dressings and although the value of the

manuring was proved, the best rate of application was not found. From dressings of 1, 3 and 5 tons per acre increases of 29%, 20% and 33% were obtained over control which yielded 619 lbs. per acre.

In areas where disease or fly precludes the keeping of stock the alternative method of maintaining soil fertility by green manuring has to be practised or it may be supplementary to the use of farmyard manure. A trial laid down in 1932 in which a six week's growth of sunnhemp was planted previous to a quick-maturing groundnut crop gave no increase in the yield of groundnuts, but the following year bulrush millet from the treated plots yielded 7.9% more than the untreated; cropped with cotton this season no significant result was obtained.

It was considered that native cultivators would not be prepared to lose part of their cropping area by taking a green manure crop, and it was decided to test the effect on the next season's crop of various green manures, planted after the main crop was removed. Sunnhemp $4\frac{1}{2}$ tons per acre, bulrush millet 4 tons per acre, and sunflower 5 tons per acre, were dug in at the end of last season and all plots cropped with bulrush millet this season. A significant increase of 67% over control, which yielded 444 lbs. per acre of grain, was the result from the sunnhemp treatment. The increases from the other treatments were not significant.

The value of both kraal manure and farmyard manure in dressings which may be considered small in raising the fertility level of heavily cropped areas such as Mwanza, is apparent. Although the action of kraal manure may be delayed in a dry season, it is available for future crops, and whether the native cultivator keeps his stock in open yards or houses he has the means at hand of raising his yields provided he will take the trouble to carry out the manures on to his land. The long term effect of manuring such soils has yet to be ascertained but it is unlikely that any condition will arise which will make manuring uneconomic.

The use of green manure, of which sunnhemp appears to be the most promising, requires the cultivator to plant some early quick maturing crop which allows the green manure crop to be dug in before or after his food or cash crop, and frequent applications will be necessary to maintain fertility.

The practice of timing native hand cultivation was again carried out in order to ascertain the time taken for one man to prepare and plant by hand one acre of each of the various crops. The after-cultivation and harvesting times are not given as it is the time taken to cultivate

and plant in the short planting season which is the limiting factor to the area a native can crop.

The results were as follows :—

Sorghum	... 10 days	Yield	... 473 lbs. grain
Maize	... 15 days	Yield	... 1,520 lbs. grain
Millet	... 14 days	Yield	... 508 lbs. grain
Cotton	... 12 days	Yield	... 220 lbs. seed-cotton
Groundnuts	18 days	Yield	... 1,000 shelled nuts

Mixed Farming.—On the seed farm which is run in conjunction with the experimental section, cattle are used as far as possible, and the experience gained is of great value in framing the policy and lines of work for the cultivators who have taken up mixed farming under our control. The feeding of stock is perhaps the most important point in mixed farming practice and it has been found that the work oxen can be kept in good condition and female stock give yields of milk much above those obtained by natives, if provided with feed which any cultivator can supply. Although grazing is very limited, very full use has been made of it by the practice of tethering, and this coupled with roughage such as maize stover, groundnut haulms from the arable land, and small quantities of elephant grass grown specially as fodder, has maintained all stock in excellent condition.

The making of millet hay and maize silage, the former yielding $3\frac{3}{4}$ tons per acre and the latter 12 tons per acre, have been successfully carried out, but only as the stock owner realises the benefit of good feeding can he be expected to carry out such practices of his own free will. A small sun-dried brick silo, 10 feet in diameter and 5 feet deep was tried this season and good silage was taken from it. This type of silo can easily be made by natives and should be useful where it is impossible to dig pit silos.

The most promising fodder crops this season were elephant grass, Dolichos bean, Ironbark pumpkin and bulrush millet hay. Edible canna, and velvet bean, although making fair growth, have not proved suitable for widespread cultivation.

Ideal Native Holdings.—Four new holdings on the perimeter of the farm were taken up this season, but as the tenants started very late they were not asked to carry out the full cropping scheme. The two established settlers have done well. They harvested good crops and worked their holdings on the lines laid down for them and there is no doubt that a much greater acreage than that cultivated by the ordinary cultivator can be cropped, and fertility maintained at an economic

level, under the system of mixed farming ; the condition of their stock is a striking example of what better feeding and housing can do for the native cattle.

The total number of hours worked on each holding during the season of 300 days averaged 2,776, which, assuming that both man and wife worked the same amount, is just over four and a half hours work per day per individual. The cash return this season was much lower than last, averaging 34/- per holding ; this was due to their poor cotton crops and the fact that they consumed all milk which previously they had sold. Against this, their food crops were excellent and actually there is a surplus available for sale. Their standard of living is high with their better housing and very ample food supplies, and is much better than that of most native cultivators.

With practice in using their work oxen the holders have been able to use the wooden plough and cultivator to a much greater extent ; they are now asking for imported implements, but as the former have proved capable of the work demanded they are to continue with these until they can purchase improved implements out of their own earnings.

Development of Station.—A number of much needed improvements and alterations were carried out on the station during the year. A house was built close to the farm for the Agricultural Officer in charge and necessary alterations carried out to the Agricultural Assistant's house. Other building work included the erection of a new store and workshop, a new cattle shed, compost house, maize crib, an underground water tank and quarters for the African staff. The dam at the end of the farm was enlarged and deepened and a spillway built.

The area of the cultivated land remains the same, but re-siting of a number of plots was carried out and with a certain amount of extra drainage and tree planting, major works will be completed.

The establishment of a rice station at Mwabogole on the Lake shore was completed and twenty acres of land can be irrigated by the pumping plant. Although primarily for rice improvement it is also to be used for the multiplication of various seed stocks during the dry season.

Nyamahona Seed Multiplication Area.—The area selected in Uzinza to serve as a cotton multiplication farm was brought a step nearer its purpose. The main development work carried out during the year was the clearing of a further 190 acres for cultivation and the clearing of a large area of bush around the building site as a protection from "fly."

The building programme was started and the following buildings are being erected :—Residential quarters for the Agricultural Assistant,

a small ginnery and workshop, two cotton stores, a cattle shed and an office. In addition to quarters for the African staff, permanent labour lines are to be built to replace the temporary camp erected last season.

The year's cropping was disappointing and although this is partly due to the light rains recorded during the cropping season and damage by locusts, this is not a complete explanation. Owing to shortage of labour, cultivation and planting were carried out late.

The following yields of cotton were obtained :—

(a) 10 acres mass selected cotton	...	...	282 lbs. per acre
(b) 15 acres local cotton	...	...	227 lbs. per acre
(c) 20 acres local cotton	...	...	137 lbs. per acre

The twenty acres (c) were planted after maize which was destroyed by locusts.

Small acreages of bulrush millet and Virginia Bunch Groundnuts were grown for seed for distribution to settlers on the farm and did well.

The thirty-eight settlers who had taken up holdings on the farm made fair progress. The large amount of clearing and preliminary cultivation entailed did not allow them to get a full acreage under crops, but with one or two exceptions they have passed through their first year well, and have obtained sufficient food and cash crops to carry them through. Until their position is consolidated they have not been asked to carry out any extra work and improved practices are to be introduced gradually.

A number of 20-acre holdings have been marked out, some of which are already taken up, and it is hoped to induce settlers to take up the balance this season.

LUBAGA EXPERIMENTAL STATION PROGRESS REPORT, NOV. 1934—NOV. 1935

BY

J. G. M. KING.

CAPITAL IMPROVEMENTS.

As it was decided that the Lubaga Farm should serve the Hinterland area of Lake Province as an agricultural centre, it was found necessary to reorganise the entire farm, and to carry out some capital improvements.

Building Work (a) The Agricultural Assistant's house was rebuilt and extended. In addition a 6,000 gallon underground rainwater tank was built.

(b) Another underground rainwater tank was constructed having a capacity of approximately 24,000 gallons. Reinforced concrete was used throughout. This tank is for the storage of rainwater caught from the surrounding roofs of the stores, offices, etc., and was used by the labour for drinking purposes during the dry season.

(c) A large open rainwater catchment tank was built adjoining the experimental area. This tank is linked up with the new anti-erosion banks ; all the surface water off the experimental area will be directed into the tank. The capacity of the tank is approximately 250,000 gallons. This supply will be used by the cattle during the dry season, the water being pumped out into troughs. The entire excavation work, with the exception of trimming up the walls, was done with ploughs and damscoops, and the total cost was under Shs. 250/-.

(d) Tool stores, implement sheds, and seed stores, were built and modified to meet the present requirements. A blacksmith's and carpenter's shop was also erected.

(e) Provision was made for the manufacture of good farmyard manure. A covered cattle yard, 80×50 feet, was built of bush timbers with a thatched roof. Low walls of mud brick were built around the building to consolidate the manure and to prevent it from drying out unnecessarily. A cattle byre was also built of native materials. It is intended to be a demonstration byre which could be constructed readily by any cattle-owning native.

(f) A dairy in the form of a twenty-foot rondavel was constructed, to demonstrate the hygienic methods of handling milk.

(g) A seventy-foot thatched barn was built for the drying out of the Feterita sorghums during the rains.

(h) In the workshops two old motor car chassis were converted into pneumatic tyred ox waggons for use on the farm. These have been in constant use throughout the year, with satisfactory results.

AGRICULTURAL POLICY AND ANTI-SOIL-EROSION WORK.

In the beginning of the season it was decided that the farm should serve as an experimental station, a Native Authority seed farm, and as an educational centre. It was apparent that the policy of the farm must be based on soil fertility conservation, and must provide adequate food for the stock during the months of the dry season. Further, it was decided that drastic steps should be taken immediately to stop the soil erosion. A three-year plan was started which included:—
(a) The building of contour and horizontal anti-erosion banks. (b) A new system of farm drainage. (c) The planting of windbreaks.

The contour banks were placed at intervals of 70 yards and were built up by hand. In the latter part of the year the remaining portions of the farm were laid out on the Havilland system and contour ridges were made with the use of a Martin's ditcher and tractor. These contour banks were put in every one-and-a-half foot vertical fall, while the banks have a discharge fall of one in four hundred. The horizontal banks dividing up the land into blocks one acre in width were used on lands having an even and regular fall, which would be used eventually for experimental purposes. This system was adopted for convenience in order to facilitate the layout of regular shaped blocks.

During the year over 110,000 yards of contour and horizontal banking were built up to an average height of 2 feet.

A new system of drainage was introduced (a) to carry off the surface water from the farm and (b) to prevent surface water from entering the farm from the adjoining native gardens. Approximately 6,000 yards of drain cutting was done.

Windbreaks in the shape of a large letter H were laid out and will be planted during the coming rains. Each windbreak consists of 6 rows of *Cassia simea* with a row of *Euphorbia* (Manyara) on each side. These outside rows will protect the young trees and will give additional density to the breaks.

EXPERIMENTAL WORK.

General.—It was decided to work in the experimental programme with the general agricultural policy of the farm, in order that the soil fertility could be restored and maintained. Further, it was decided

Both experiments were calculated in seed-cotton and lint figures, the ginning percentages were taken as 31.5% for the Mwanza Lake Shore cotton and 34.5% for the U.4/4/2 variety.

Experiment No. I.

Seed Cotton Figures.—The Mean Difference was greater than the standard error of the Mean Difference by 6.2 times. U.4/4/2 showed an increase in yield of 71.5 lbs. per acre, or 15.4%.

Lint Figures.—In terms of lint the Mean Difference was greater than the Standard Error of the Mean Difference by 47.7 times. The increase in yield was 46 lbs. per acre, or 32% increase.

Experiment No. II.—Gave similarly significant results.

Seed Cotton Figures.—The Mean Difference was greater than the Standard Error of the Mean Difference by 13 times. U.4/4/2 gave increase in yield of 81.2 lbs. per acre, or 19%.

Lint Figures.—Mean Difference was greater than Standard Error of the Mean Difference by 71 times. U.4/4/2 showed an increase of 51.80 lbs. of lint per acre, or 37%.

(b) *Observation and Selection Work.*—Observation plots of one-sixth of an acre were laid down, and a comparative study was made of various Barberton selections, local cotton (U.4/4/2), local selections, and selections from Gatooma and Ukiriguru, and Mwanza bulk. Field scale plantings were also made of some of the above. Single plant selections were made from the field scale plots and also from the district cotton. These will be planted in the coming year to the number of roughly 200. Some of the Barberton selections appeared to be the most promising as a result of the season's observations; three of the Mwanza types also contained many plants of promise.

Climatic Conditions.—The conditions generally were unfavourable to the growth of cotton. The rainfall distribution was very uneven, torrential downpours being followed by long spells of hot dry weather.

Pests and Diseases.—Conditions were favourable to the incidence of disease. In April and May all cottons suffered from a severe attack of jassid. Considerable damage was done to the cotton by *Dysdercus*, and by American and Spiny Bollworms. The percentage of stained cotton at harvest amounted to nearly 50%. It is interesting to note that no strain proved outstanding as regards its resistance to jassid. Taken as a whole the U.4 derivatives showed a higher resistance than the Uganda Upland types, but none of the U.4 types displayed the degree of resistance to jassid which they normally show in their place of origin. It would appear that the Shinyanga area constitutes the borderline for the successful growing of this type. A more jassid-resistant type is required, and a U.4 × Cambodia hybrid has been suggested for trial during the coming year.

OTHER EXPERIMENTAL WORK.

1. *Awned Bulrush Millet v. Native Bulrush Millet.*—Half-drill replicated 8 times. No significant difference in yield between the two

types was obtained. The awned millet was grown on account of its reputation of being immune to damage by birds. Although no significant differences were obtained, it is considered that the awned types do possess a certain amount of resistance to damage, especially from small birds. Further selection work is required as there was a considerable variation in the degree of awnedness.

2. *Native Groundnuts v. Virginia Bunch*.—Half-drill strip, replicated 8 times. Each variety was planted at its optimum spacing and the land was tie-ridged. Information was required as to the relative merits of each variety if planted under these conditions. The native variety gave a very significant increase in yield. The Mean Difference was greater than the Standard Error of the Mean Difference by 150 times.

THE NATIVE AUTHORITY SEED FARM.

Quite apart from the production of seed supplies for the ultimate distribution to the natives, the seed farm acted as a training centre, a demonstration farm, and a ploughing school.

Multiplication of Seed.—The following quick-maturing varieties of seeds were grown for distribution purposes. These have been sent out to the areas of potential famine and have been exchanged on a *quid pro quo* basis by the respective native chiefs:—Feterita sorghum, 15,000 lbs. ; Virginia Bunch groundnuts, 2,200 lbs.

In addition, awned bulrush millet was grown and sent out to the areas severely infested with *Striga*. Over 10,000 lbs. of seed was exchanged also.

It was decided that the free issue of seed was undesirable and that the exchange method should be adopted. It has proved very popular and the demand for seed was keen.

Education.—A small adult school is in its inception for those illiterate natives wishing to become better agriculturalists. The buildings and equipment await the approval of the Native Treasury Estimates. During the interim period evening classes were started for those who wished to attend.

An agricultural training centre for the instruction of literate natives for employment as agricultural instructors, market supervisors and produce graders is also in its inception.

The Ploughing School.—Facilities were provided throughout the year for those natives who wished to learn to plough or who wished to have their oxen trained. In addition, in order to popularise the use of ploughs, the small Ndyabo ploughs (2 or 4 oxen) were hired out to the natives with oxen for the charge of 2/- a day. Many natives availed

themselves of this facility. Since harvest time several small ploughs have been sold to natives, and orders have been placed for the purchase of inter-row cultivators.

Individual Native Holdings.—Two individual native holdings were started during the year at Lubaga, and two at Ibadakuli, with the object of demonstrating to the natives the advantages of mixed farming methods on a fixed site, as opposed to shifting methods of agriculture. These holdings, which were started primarily for demonstration purposes, served also as experimental holdings for the acquisition of information on mixed farming under the local conditions.

These holdings were laid out on the following lines :—

Unit of Holding.

(a) Personnel. A family of 3 persons.

(b) Stock. 5 Head : 3 working animals ; 2 dairy cows.

Size of Holdings. 20 acres.

(a) Under cultivation, 10 acres.

(b) Under grazing, tree-planting, etc., 10 acres.

The holdings were designed so as (a) to provide an adequate supply of food for the tenant's family and stock ; (b) to provide cash for his requirements ; and (c) to maintain the holding in good heart.

The cropping of the holdings, quite apart from the three main objectives, was such as to distribute the peasants' work as evenly as possible throughout the season, to provide roughage for the manufacture of farmyard manure, and to maintain the stock in a fit condition for work throughout the year. This was made possible by the introduction of a simple 4-course rotation and the use of quick-maturing crops such as Feterita sorghum and Virginia Bunch groundnuts.

The 4-course rotation was :—

1st Year.—Farmyard manure, then Pennisetum.

2nd Year.—Cotton.

3rd Year.—Sorghums.

4th Year.—Groundnuts followed by green manure.

The cropping of the area under cultivation was :—

Food Crops.—2 acres native sorghum ; 1 acre Feterita millet ; 1 acre maize under-planted with beans ; 1 acre house plot-beans, vegetables, pigeon pea, etc.

Cash Crops.—2 acres cotton ; 1 acre groundnuts.

Stock Food.—1 acre Pennisetum ; 1 acre maize cut green or $\frac{1}{2}$ acre elephant grass ; $\frac{1}{2}$ acre maize.

In spite of the late start which was made with these holdings, satisfactory results were obtained.

Equipment.—Each holder was given a house, etc., cattle shed, and was provided with a small plough (Ndyebo), 3 working oxen, 2 milking cows, and seed for planting.

These holdings have been the source of a considerable amount of interest among the local natives. It is intended, after the water supply is assured, to divide up the perimeter of the 2,000 acre reserve, and establish a settlement of peasant farmers.

MOROGORO AGRICULTURAL STATION, PROGRESS REPORT FOR THE SEASON 1934-35

BY

N. V. ROUNCE.

Four cotton trials were laid down of which the two local selection trials were complete failures owing to the seed not being viable, following upon the unsatisfactory climatic conditions in 1934. The two "introduced-strain" trials gave interesting results, but owing to the strains having been introduced direct from Barberton and Nyasaland respectively, new-place effect may have been a factor in inordinately increasing the yields of the introduced seed. The yields given below are sufficiently high, however, to give hope of some of the strains continuing to be significantly higher yielders than the local kinds :—

I. BARBERTON STRAINS.

	Strains in order of yield.	Seed-cotton : lbs. per acre.	Difference required for significance.	Ginning %
1.	998	1,204		36.5
2.	955 or U.4	949		36.3
3.	920	930		34.7
4.	U.4 or 955	699	46 lbs. per acre.	36.3
5.	U.4	653		34.4
6.	Local	434		31.7

Each shows a significant difference from the others excepting 920 over U.4 or 955.

II. NYASALAND STRAINS.

	Strains in order of yield.	Seed-cotton : lbs. per acre.	Difference required for significance.	Ginning % Lint length.
1.	U.4/4/2	1,052		35.5
2.	N.3	785		35.0
3.	U.4/2	757		34.3
4.	U.4/4/2 or 985	720	188 lbs. per acre.	35.1
5.	N.10	688		35.4
6.	214	622		36.1
7.	C.28	602		36.6
8.	Local	555		32.0

U.4/4/2 is significantly higher yielding than all the remainder. Local cotton is a lower yielder than U.4/4/2, N.3 and U.4/2. N.3 is a higher yielder than C.28 or Local. U.4/4/2 on these figures will produce 368 lbs. of lint per acre compared with 172 of Local.

The basis of the selection work in the field has been broadened to include types which may give a lint similar to that typical of the area at present, or even slightly inferior to it, as it is thought that too much emphasis on improvement in the quality of lint may reduce our chances of isolating a higher-yielding type. A large number of selections have been taken in the field in order to give plenty of material to work on. Unfortunately, all the 1933 strains have been completely lost owing to the unfavourable climatic conditions mentioned above, and only a little seed has been obtained from the long-linted type mentioned in last year's report. Of the 1932 selections a little seed has been harvested of which No. 3249 still gives promise.

The Moco cotton received from Dr. Harland, and planted in 1933, has again proved unsuccessful. The little seed obtained failed to germinate and now two of the original plants only are left, struggling for existence.

MPANGANYA EXPERIMENT STATION, RUFIJI, PROGRESS REPORT FOR THE SEASON 1934-35

BY

H. MARSLAND.

After an inactive period of four years, Mpanganya was reopened as an Experimental Station in November, 1934. The former experimental areas were carrying a profuse growth of grass and secondary bush typical of the Rufiji district and presented a somewhat derelict appearance. Initial operations were therefore devoted to

fellings and clearing and making general preparation for planting in February, 1935.

The station serves a population of 80,000 people, mainly concentrated at or near the Rufiji river, which roughly bisects the Rufiji district. Records show that cotton has been grown in this area since German times, but with mixed success. The production of rice is of paramount importance, being the staple crop of the native cultivator; thus it is desirable that investigation of both crops should proceed side by side. The natives have shewn a general apathy towards cotton-growing, but it is obvious that other reasons exist which have contributed to its lack of popularity, e.g. successive failures of the crop, often ascribed to climatic conditions, but probably also due in a large part to the actual strain of cotton cultivated.

Rice is ever popular; its cultivation is understood by most natives and the price obtained is a very high one.

The programme of work for the Station was therefore drawn up with the following motives:—

(a) To evolve a type of cotton, if possible from the existing variety already in general cultivation (referred to as Uganda Upland), more suited to the peculiar environmental conditions of the Rufiji district and capable of showing a more regular and longer staple length.

(b) To examine the behaviour of the existing varieties of rice with a view to the elimination of the majority and the improvement of a selected few for distribution throughout the district.

CLIMATIC CONDITIONS.

It is unfortunate that the first year's operations have been marred by unfavourable climatic conditions. Although the total rainfall for the period February to July inclusive was only 1.7 inches below an eight year's average for the same months, yet the distribution was particularly bad. In the month of April there was a total of 0.85 inches only as compared with an eight-year average of 9.85 inches. A complete drought of 19 days was experienced and the total for the month, being spread over five days, was thus ineffective for plant growth. Concurrently with the drought, the river rose abnormally high and washed away a considerable acreage of native rice. During the month of May there was a total precipitation of 4.05 inches as against an eight years' average of 2.20 inches; this saved the rice crop from destruction, but cotton, which had progressed with advantage during the drought by reason of the high water table occasioned by the swollen river, now suffered from over stimulation and consequent heavy vegetative growth.

COTTON.

Planting was commenced at the end of February and continued until the middle of March, as follows :—(a) A bulk crop of Egyptian cotton. (b) A half drill strip experiment with U.4/4/2 and Local cotton. (c) An observation plot of U.4/4/2. (d) Selections received from Morogoro—Mp.9, Mp.17, Mp.19, Mp.42, Mp.92, M.J.R.245, M.J.R.249, M.J.R.250, M.J.R.253, M.J.R.251, M.J.R.244. (e) A bulk plot of Local cotton.

Growth.—The seed of the M.J.R. strains was unfortunately of poor quality having apparently deteriorated during storage; stands were therefore extremely patchy. The rest of the cotton, however, made excellent growth and fine stands were obtained. All cotton was planted at a spacing of three feet by eighteen inches and thinned to two plants per hole at the beginning, but later, in view of the good condition of the crop, it was again thinned to one plant per hole. Without exception all strains progressed remarkably well during the month of March. Aphis attack was generally noticeable, but disappeared in the hot dry weather of April and did no damage. With the heavy rains of May the plants grew into trees of 6 to 8 feet tall and the plots presented an almost impenetrable mass rendering selection work extremely difficult.

Bulk Crop.—The bulk crop of local cotton was intended for selection work. Fifty-six plants of good shape and short stature were marked at the time of flowering. These were selfed and some, irrespective of lint qualities, will be planted in progeny plots next season. The need for a less vegetative type of plant for the Rufiji is pressing. Selections of over $1\frac{1}{4}$ inches and approximating to $1\frac{1}{2}$ inches lint length were made from this plot. In addition, a mass selection of plants under 5 feet in height was taken.

Egyptian.—It was evident from the seed that the so-called Egyptian was far from pure. An average height of 7 feet was attained; the yield was poor.

U.4/4/2.—U.4/4/2 was outstanding by its wealth of bolls, good form and comparative shortness of stature (average height 5 feet only). A yield of 1,171 lbs. per acre was obtained with mean lint length of $1\frac{1}{16}$ ins., fairly regular. The lint appears much stronger than that previously examined in drier parts of the Territory. Selfed seed is available for next season and one or two promising selections have been made.

Half Drill Strip.—The half drill strip experiment was laid down with ten replicates of U.4/4/2 and ten replicates of the Local cotton. A statistically significant result in favour of U.4/4/2 was obtained,

the mean yields per acre being 624 lbs. for U./4/4/2 against 552 lbs. for the Local strain.

Selections.—The whole of the selections received from Morogoro (the M.J.R. group) proved disappointing in germination, stands obtained ranged from 5% to 11% only of the possible totals. Most of the plants made excessive vegetative growth and fell over or trailed on the ground. The lint is strong, particularly that of M.J.R.243, 244, and 245, but showed no advance in length over that of the local cotton. The yields per plant were obviously very good, but on account of the poor stands no comparison was made. The Mp. selections were originally made at Mpanganya a number of years ago and have been kept going by selfing, but it is suspected that crossing has occurred in the meantime. Unwieldy growth occurred, the lint strength is now not outstanding, but yields of 760 lbs. and 570 lbs. per acre were recorded from Mp.12 and Mp.17 respectively. Selfed seed of all the strains has been obtained, but the success of cotton-growing in the Rufiji district would appear to lie in the evolution of a less tall type than any of the strains tried this year, with the possible exception of U.4/4/2, which however, for the present at any rate, is ruled out on account of its shortness of staple and its predisposition to diminish in yield after acclimatization.

Crosses between U.4/4/2 (female) and typical Egyptian (male) were made and the seed from five bolls is available for planting and back crossing next year.

INSECT PESTS.

The most troublesome pest of the season was Pink bollworm (*Pectinophora gossypiella*) and this combined with the high incidence of cotton stainers (*Dysdercus* Sp.) resulted in diminished yields with no clean pickings. Rain-grown cotton throughout the district was generally infested by pink bollworm. In connection with insect pests reference must be made to a method of cotton culture, locally termed "*Mlao*," of which some investigation has been made this year. A mlao crop is one which is planted on the rich alluvial deposits, at or near the river after the floods have subsided and exposed the areas for cultivation. By reason of the high water table in such areas, crops of cotton and maize, etc., can be grown and matured, practically independent of rainfall. Thus in the Rufiji district we have two systems of cotton cultivation, namely :—

(a) Rainfall cotton which is planted on areas not subject to flooding, in the months of February (latter end), March, April and even May.

(b) Mlao cotton which is planted in May, June and July as the inundated areas become exposed for cultivation.

The mlao areas are of course determined by the volume of the floods. An abnormally high flood this year has resulted in a large acreage of mlao and consequently it is expected that two-thirds of the total cotton crop of the Rufiji will be produced from mlao areas. Furthermore mlao cotton appears to be remarkably free from disease and insect pests. In view of the similarity of conditions with those of the Tokar delta in the Sudan, experiments with Tokar Sakel are contemplated for next season on typical mlao areas.

RICE.

The planting of rice commenced on the 19th of February and consequently early growth was considerably retarded by the drought period of April. From the whole series of experiments it was practically impossible to gauge the normal behaviour of the strains and varieties under trial as all were stunted and considerably below normal height; nevertheless the drought-resisting properties of each is indicated in the ultimate yields.

Observation plots of 21 varieties were planted and yields varied from 1474 kilos per acre with a variety known as Kilimali, to 532 kilos per acre with Alibasi. The number of days to maturity ranged from 112 days with Mwanga to 132 with Marula and Rusukwe.

Samples of seed from each of the 21 plots were tested for moisture content. Initial periods of 6 hours in the drying oven gave no appreciable differences in moisture content. Further tests of 12 hours' duration at 94° C. were therefore made when the results varied from 10.3% in Akirimali and Afaa Mpemba to 9.2% in Marula. The experiments were carried out with a view to ascertaining whether or not any correlation exists between moisture content and storage properties, but from the results obtained it would appear that the actual chemical constituent of the seed is more likely the determining factor. Mass selections of all the varieties were made with a view to providing purer seed for multiplication and the collection of rice varieties now approximates to 70.

A randomised block was laid down with 21 treatments and twenty replicates. The results are summarised as follows:—

1. Likote and Borakupata are significantly superior in yield to Kajua, Rusukwe, Afaa Mpemba, Afaa Mkoma and Marula.
2. Likote, Borakupata, Nghoe and Ngwimsimba are superior in yield to Afaa Mpemba, Afaa Mkoma and Marula.
3. Komango is significantly greater than Afaa Mkoma and Marula.
4. Bungala is significantly greater than Marula.

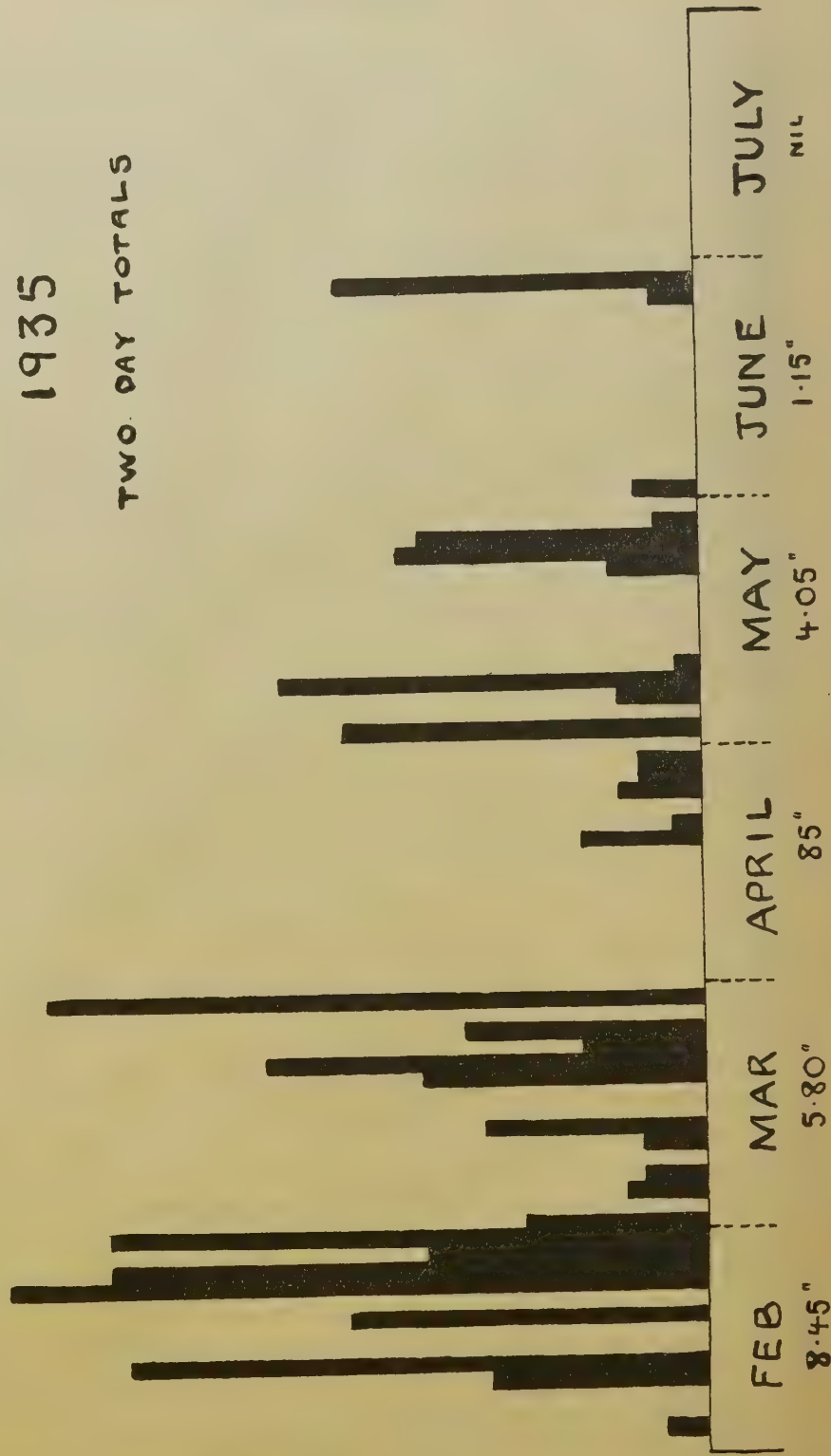
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MPANGANYA RAINFALL

1935

TWO DAY TOTALS



SUMMARY OF WORK ON PESTS AND DISEASES.

The following account has been compiled from statements that have kindly been supplied by members of the Entomological and Pathological staff.

Pests.—An outstanding feature of the season has been the prevalence of damage by *Helopeltis*, which has been fairly general. It is suggested also that attack by the less conspicuous hemiptera is responsible for a good deal of the loss of crop in certain areas, while the larger pests, which are more obvious of themselves and to which the damage is frequently attributed, are, as a fact, less harmful.

In the Morogoro district there has been a recrudescence of the cotton *Apion* weevil; this fact and the evidence regarding attacks by pink bollworm go to show that "dead season" sanitation measures need to be applied more strictly. The pink bollworm in Tanganyika has apparently only one host plant, namely, ochro or bamia (*Hibiscus esculentus*). It has not been observed on any other of the many wild malvaceae, and larvae of long-resting period do not occur. A considerable measure of control should therefore be possible by strict sanitation measures between the seasons.

In the Western Province a new bollworm of cotton, *Platyedra* sp. has been found in Kidney cotton, and immediate measures have been taken for the eradication of wild and cultivated cottons in the district in order to safeguard the cotton of the Lake Province.

A pest recorded for the first time in the Territory, also found on Kidney cotton in Kigoma, was the secondary bollworm, *Plemyrstis oenochares*, Meyr. This insect appears to attack only those bolls which have already opened, and is of little importance.

The cotton in the Lake Victoria shore area, near Mwanza, has in some localities again shown signs of injury due to capsid attack. The general effect of the plant is to induce monopodial growth: the leaves are found to be perforated and crumpled, and flower buds are shed. Capsids, mainly of the genus *Lygus*, are found in numbers around the growing point. The Government Entomologist, Uganda, has kindly examined specimens of the injury and of the capsids, and they correspond with the capsids and the damage caused by them already reported in that country.

Diseases.—Correspondence and reports from the districts confirm observations of previous years that pests are more important than diseases in this Territory.

As in former years, the chief disease was Internal Boll Disease (*Nematospora* spp.) which was present in all cotton areas. The Moshi district in which the plant pathologist was stationed during the year was exceptionally healthy ; even the Aneolate Mildew, which was so common elsewhere, was rare there.

There is still no evidence that Blackarm is sufficiently in evidence anywhere to justify control measures. Angular Leaf Spot was rather more common during the past season.

NYASALAND COTTON EXPERIMENT STATION, DOMIRA BAY, PROGRESS REPORT FOR THE SEASON 1934-35.

BY

H. C. DUCKER, W. L. MILLER AND S. T. HOYLE.

COTTON.

It is impossible to discuss the past season's results without laying great emphasis on the rainfall distribution, though the total was just about up to expectation. The rains broke at the end of November and planting took place in early December under ideal conditions. The cotton grew well till early February when flowering was general, which is about a fortnight earlier than normal. From February 9th there was a drought which was not properly broken till March 17th. The effect of the drought, coming as it did at the period when the cotton should have been setting its main crop, was to turn the normal single peaked flowering curve with its maximum at the end of March, to a double peaked curve with maxima at the end of February and the end of April, with a very marked trough between them. Though the total number of flowers per acre was not reduced, the final result was to reduce the bulk crop from a normal average of about 250 lbs. to 160 lbs. lint per acre. Some part of this reduction in yield was due to the drought increasing the amount of natural shedding, but the greater part was due to insect attack, the reasons for which are discussed below.

The bulk fields were all sown with various strains of U.4, the most successful of which was once again the C.28 strain from Barberton. A half-acre increase plot of a local re-selection within this strain yielded at the rate of 220 lbs. lint per acre in spite of the conditions.

In the breeding-block the re-selection work within the U.4 strains was continued; some of the re-selections are definite improvements and are being used to replace the existing bulk seed stocks on the station.

There is a varied selection of crossbred material and at present it is only possible to say that some of it shows promise. Probably the best of these is the (U.4 $\times$ Cambodia) $\times$ U.4 cross. It is interesting to note that there is a distinct difference in plant habit between the progeny of this cross made on the station, now in the F₄ generation,

and that of the seed sent by Dr. Harland, the latter being much smaller and more compact, though there seems little difference in their yielding powers. Some of Dr. Harland's crosses with Jamaica Xerophytic in their make-up look as if they should be useful in those areas in which a quick maturing cotton is not a necessity.

PESTS.

Locusts.—Small swarms of Redwinged locusts first appeared over the station in the last week of November and continued throughout December and the early part of January. Some young cotton plants were eaten and supplying was necessary in a few of the bulk fields. The damage done in the spacing and strain trials was sufficiently serious to render the results from these experiments invalid. Considerable damage was done to the maize on the station and in native gardens in the vicinity. A good deal of egg-laying took place and though some hoppers were hatched out, none of these reached maturity. It is thought that most of the eggs laid were eaten by the larvae of Cantharid beetles. The few hoppers which did hatch out were all killed by a fungus disease or other causes, and many of the adults were also killed by fungus disease. No locusts of any sort were seen on the station after the middle of February.

Stainers.—As noted above, there was more stainer damage this season than there has ever been on the station. This can largely be explained by the February-March drought. The primary migration into the cotton fields began in the same way as last year, but in the dry conditions of the last half of February many of the wild plants, mainly Hibiscus spp, which are a favourite food of the stainer, became less attractive than the cotton. The result was that in the middle of April when the rise of the second peak of the flowering curve began, there was a considerable population of stainers in the fields. But for the drought, the rise in stainer population would not have begun until flowering was nearly finished. The delayed flowering meant that there was a high stainer/boll ratio, especially in the early stages of the crop which Pearson has shown to be the most susceptible time. A very great deal of damage was caused by stainers, though exactly how great a loss in quantity and quality it is impossible to estimate. So far as one can tell from past records, the peculiar conditions of last season are not likely to be repeated frequently and no undue concern need be felt because of the results for this season. It was noticed that some native gardens 15 miles away on which some rain fell during the drought period at the station were not nearly so badly affected.

The course of infestation of *D. intermedius*, except for a slightly greater initial migration, was similar to last year's, rising to a peak of 1,500 adults per acre at the end of May and then falling away rapidly. *D. fasciatus* followed the same course until May and then, instead of falling away, rose steeply to a maximum at the end of June with an estimated population of 4,000 adults and 8,000 fifth instar nymphs, per acre. These high figures, presumably due to the extended flowering period, go far to explain why there was so much staining even though the crop was well advanced when the population peak was reached. Even so, it is probable that the greater part of the damage was done in the early stages of the crop.

D. superstitiosus was found in very small numbers and *D. nigro-fasciatus* recorded only twice.

At present there is nothing further to add to last year's report on wild host plants.

American bollworm.—In the past American bollworm has not been of great importance and always less so than Red bollworm. This year much damage was done and as with stainers the increased damage this year can mostly be put down to the February-March drought. It is highly probable that the past immunity from serious bollworm damage to cotton, both native grown and on the station, has been due to the numerous counter attractants, principally maize, but also groundnuts, sorghum and other millets. On the station it has been the practice to plant these crops at one time, but in native practice there is a considerable range of sowing date in any area and so there is an extended flowering period when the plants are attractive to the boll-worm moth. This year many of the earlier plantings of maize in the surrounding native gardens were eaten by locusts and the re-plantings had a smaller range of sowing dates than is usually the case. The drought also reduced the crop and hastened the end of the flowering period, so that taking the district as a whole there was less crop and less time in which maize acted as a counter-attractant for the egg-laying of *Heliothis*. Thus, although much damage was done by bollworm it is thought that it can be largely explained by the peculiar season and that it is not likely to recur frequently.

Sudan bollworm was present in about the usual numbers. Records of egg-laying and larvae of both American and Sudan bollworm were made and the numbers recorded seemed to be less than would be expected from the damage done. This may have been due to a high percentage survival or to the fact that the native recording staff were not previously experienced in this work. A more elaborate scheme has been drawn up for the coming season.

ROTATION CROPS.

Most of the rotation crops suffered directly or indirectly from the unusually uneven distribution of rainfall during the growing season. Maize was planted early (end of November) and germination was good, though some damage was done by locusts. The greatest damage, however, was by white ants during the drought. An enormous number of stalks were damaged or eaten through and the unripe cobs damaged on the ground. From the native grown selections 220 rows of 55 yards were planted and from these some 35 have been retained for further trial.

Groundnuts only produced some 60% of last year's yield, flowering coincided with the drought period and the ground became very hard.

A Latin square variety trial showed the Barberton strain to advantage both in yield and percentage of shelled nuts. There was little to choose between the station seed and a variety from the Gambia. A closer spacing than was used is indicated for the latter variety and for the Barberton strain. A local native running strain proved later in maturing than the bunch types, and suffered badly from the dry conditions. Beans were practically a failure owing to, firstly, destruction of the early sowings by locusts, secondly, attacks by flower-eating *Cantharides* beetles on the supplies, and thirdly, the drought. Green Gram however did fairly well in spite of the conditions, and has again proved a valuable crop for the Domira Bay area. Even the Pigeon Pea, *Cajanus indicus*, has suffered from the drought, and the way in which second year ratoons have died out during the hot season, October/November, would indicate that the effective rainfall this season was very low, especially towards the end of the season.

BUILDINGS.

It had been intended to establish the headquarters of the Corporation at Lilongwe, but various considerations rendered a change of plan desirable and permission has been given for the Cotton Specialist's office and house to be built at Domira Bay. An admirable site has been found for buildings on the Experiment Station, and they should be complete and ready for occupation before the end of the financial year. The house is very similar to that built last year and the office conforms to the other offices and laboratory in its design.

A double garage for visitors' cars has been erected, and eight double huts added to the labour lines.

LILONGWE.

Owing to the change in plan for the site of Mr. Ducker's house it has been decided to abandon the idea of a separate sub-station for

cotton work near Lilongwe. Instead, the Government have granted facilities at the Lilongwe Experimental Station. This has the advantage that if, in the future, it should be proved that cotton is not an economic proposition on the Lilongwe plateau, the capital expenditure involved will not be wasted, but will be made use of by the existing station. A total of thirty acres has been set aside for experimental work; of these ten acres will be planted with cotton annually.

During the past season the rainfall at Lilongwe was somewhat similar to that at Domira Bay, with a marked drought in February/March. In spite of this the results were very much better than last year. There was much less damage due to staining and this may be correlated with the fact that the rains did not continue so late as last year. It is to be expected that there will be even less staining in a year in which the rains carry on till April without a serious break, and then finish.

Among the strains tested the introductions from Gatooma were outstandingly good, especially G.4(14) followed by G.5(123) and G.5(79). Some observation blocks of close spaced cotton (3 ft. $\times$ 1 ft. with 2 or 3 plants per hole) also showed to advantage. This confirms what had been previously thought namely that cotton-growing conditions at Lilongwe resemble those at Gatooma more than those at Domira Bay. A further fact bearing on this is that the type of growth and distribution of *Sterculia* spp. bears a general resemblance to that in Rhodesia. In consequence of this most of the area under cotton at Lilongwe this year will be devoted to the various Gatooma strains and a new introduction of the parent strain of G.4(14).

Owing to the amount of staining last year there was a very poor stand among the local selections. Some of these showed up fairly well and about fifty single plant selections were harvested.

In addition to the plot at the Lilongwe Experimental Station, eight European estates, scattered over the Lilongwe plateau, kindly put in observation plots. The results from these were not consistent but one at least yielded at the rate of 200 lbs. lint per acre and some of the others were distinctly encouraging.

Stainers were counted, but owing to the small area under cotton and the imperfect stand, the quantitative results cannot be considered very reliable. The course of the infestation appeared to follow somewhat the same course as at Domira Bay, starting in March and reaching its maximum in the latter half of May.

Thespesia rogersii is distributed generally throughout the area and seems to be the commonest perennial host plant. *Sterculia triphaca*

and *S. quinquialoba* are not common and when found are usually stunted and growing on rocky outcrops. In addition there are various annual herbs mainly *Hibiscus* spp. which have not yet been identified.

THE COTTON INDUSTRY IN NYASALAND.

The increased yields resulting from the introduction of U.4 cotton to Nyasaland by the Corporation, effective cotton-growing propaganda by Government, and the general improvement in transport facilities consequent on the opening of the Lower Zambesi Bridge and the extension of the Nyasaland railways to the Lake, have resulted in the increase in cotton production foreshadowed in last year's Progress Report.

The crop is not yet completed, but it is believed that the total for the country will amount to some 18,500 bales (400 lbs.). This is a very great increase on the previous record of 10,700 bales achieved in 1933/34, and there are signs that provided cotton prices remain at about 6d. a lb. for American Middling at Liverpool, further increases are to be expected in the future.

Most of the crop was again produced by the Lower River areas, but the south-western Lake shore areas are being rapidly opened up and developed, and it is not impossible that two years from now they will take the lead in production.

Satisfactory results were again obtained on Mr. Wallace's Chikwawa estate some twelve miles north of the Domira Bay Station. This estate, where cotton is grown by tenant producers, has again been supplied with seed from the Experiment Station. It is the source of a very valuable seed supply whereby the standard of the commercial crop in the country is being raised, and it is of interest to report that cotton from this estate obtained first prize at the Nyasaland Agricultural Show.

The Estate was fortunate in that during the drought period it received rains which missed the Station, and average yields were well up to the excellent standard set last season.

SEASONAL RAINFALL.—DOMIRA BAY EXPERIMENT STATION. 1934/35.
IN INCHES.

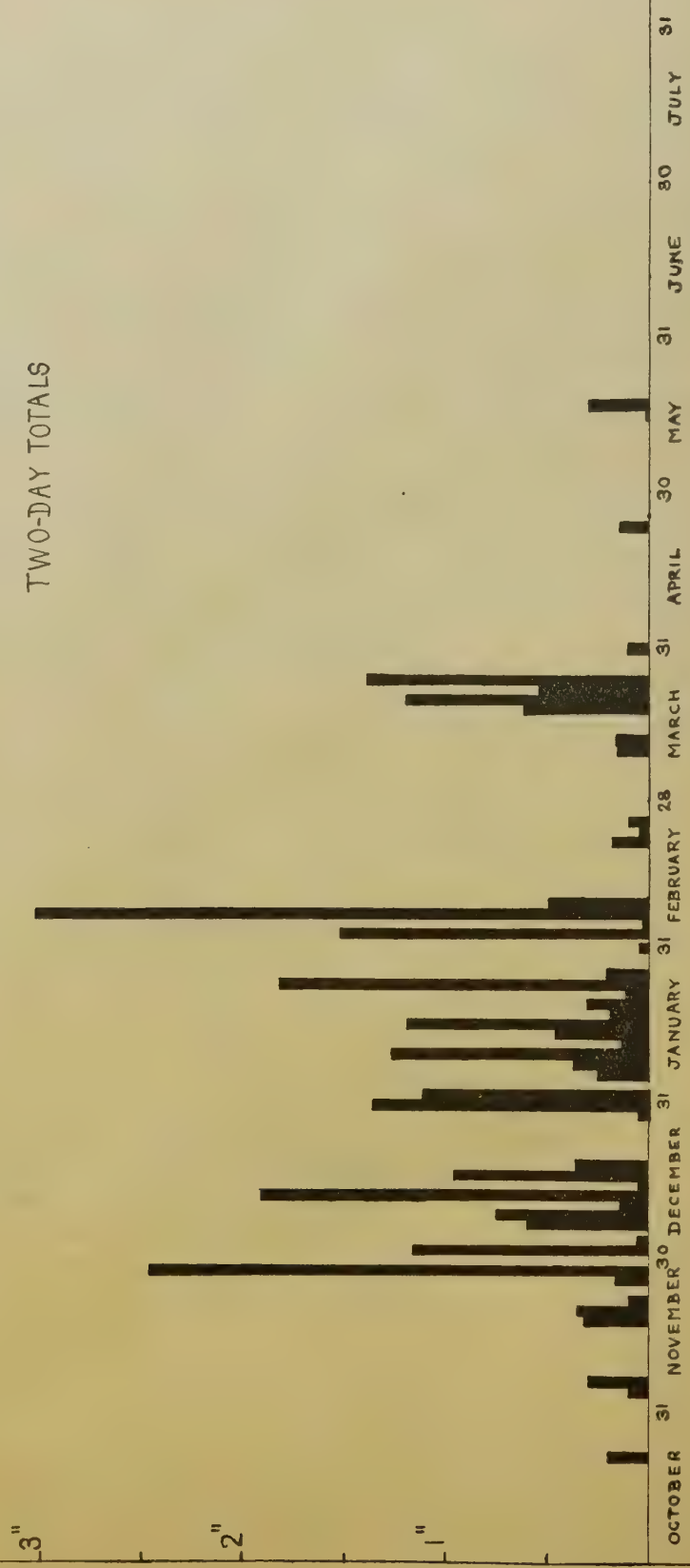
			<i>Oct.</i>	<i>Nov.</i>	<i>Dec.</i>	<i>Jan.</i>	<i>Feb.</i>	<i>Mar.</i>	<i>Apr.</i>	<i>May</i>	<i>June</i>
1 ...	...	...	...	...	0.06	0.82	...	...	...	...	...
2 ...	...	...	...	...	...	...	0.89	...	...	...	...
3 ...	...	...	...	0.10	...	...	0.63	...	...	...	...
4 ...	...	...	...	0.22	...	...	0.02	...	...	...	...
5 ...	...	...	...	0.07	...	...	0.01	...	...	...	...
6 ...	...	...	...	...	0.60	0.25	3.00	...	...	...	...
7 ...	...	...	...	Tr.	Tr.	...	0.02	...	...	...	...
8 ...	...	...	...	...	0.75	0.37	0.40	...	...	...	...
9 ...	...	...	...	...	0.10	0.61	0.09	...	...	...	...
10 ...	...	...	...	...	0.04	0.64	...	0.16	...	...	...
11 ...	...	...	...	...	0.90	0.13	...	...	...	...	...
12 ...	...	...	...	...	1.00	...	...	0.07	...	...	...
13 ...	...	...	...	...	0.04	0.20	...	...	...	...	...
14 ...	...	...	...	...	...	0.26	...	...	...	...	...
15 ...	...	...	...	...	0.83	1.04	...	...	...	...	...
16 ...	...	...	...	0.33	0.13	0.40	...	...	...	...	...
17 ...	...	...	...	...	0.09	0.19	...	0.61	...	0.01	...
18 ...	...	...	...	0.01	0.27	...	...	0.42	...	...	...
19 ...	...	...	...	0.32	...	0.14	...	0.77	...	0.29	...
20 ...	...	...	0.21	0.01	...	0.16	...	...	...	...	...
21 ...	...	...	Tr.	...	...	0.11	0.18	0.54	...	...	...
22 ...	...	...	...	...	...	0.01	...	0.96	...	...	...
23 ...	...	...	...	...	...	0.82	0.05	0.42	...	...	...
24 ...	...	...	...	...	...	0.99	0.10	...	0.09	...	...
25 ...	...	...	...	0.17	Tr.	0.22	...	...	0.06	...	...
26 ...	...	...	...	1.38	...	...	...	...	...	...	...
27 ...	...	...	...	1.08	0.01	...	...	...	...	...	...
28 ...	...	...	...	...	0.04	...	...	...	...	...	...
29 ...	...	...	...	...	0.08	...	...	...	...	...	...
30 ...	...	...	...	1.16	1.28	...	...	0.11	...	...	...
31 ...	...	...	...	...	0.30	0.04	...	...	...	...	...
Total	...	...	0.21	4.85	6.52	7.40	5.39	4.06	0.15	0.30	—

It will be noted that there was no effective rain between February 9th and March 16th.

RAINFALL DOMIRA BAY SEASON 1934-35

TWO-DAY TOTALS

3"
 2"
 1"



TOTAL FOR SEASON 28.67"

NIGERIA.

PROGRESS REPORT FROM THE CORPORATION'S SEED FARM, DAUDAWA, 1934-35.

BY

G. BROWNE AND A. E. CASEMENT.

The following Report covers the period November 1st, 1934, to October 31st, 1935.

CROPS.

Cotton.—It will be remembered that the cotton crop for the season 1934-1935 was all "Strain L" as in the previous year. At the time of writing last year's Report the crop was very promising and even at the time of picking looked like giving a record yield. Unfortunately an entirely unforeseen storm occurred on the 11th of February; rain was preceded and accompanied by strong wind and thunder. This caused quite an amount of shedding and the remaining open bolls were filled with dust beaten in by the rain. The result was that cotton picked after this date was far from good.

The total area under cotton for 1934 consisted of 728 acres on the Main Farm and 130 acres on the Co-operative Farms. The amount of No. 1 seed cotton was 185,773 lbs. and of No. 2 grade 2,003 lbs. on the Main Farm, while the No. 1 grade from the Co-operative Farms amounted to 30,544 lbs. The average yield per acre on the Main Farm was 258 lbs. and on the Co-operative Farms 234 lbs. per acre. Of the 728 acres on the Main Farm, 60 acres were interplanted with guinea-corn for ensilage, 80 acres were grown through bullrush millet and 60 acres through maize. The average yield per acre of the cotton interplanted with guinea-corn was 268 lbs.; following millet 169 lbs; and after maize 222 lbs., while the average on the rest of the farm (the area under straight cotton) was 255 lbs. per acre. It must be here pointed out that the maize crop was a complete failure, and therefore cannot be used for purposes of comparison. Maize can only be grown on rich land, and when it has been interplanted with cotton in those experiments carried out by the Agriculture Department in which the maize was a successful crop, it has proved to have as detrimental an effect on the cotton as has millet.

The No. 1 grade seed cotton from the Main and Co-operative Farms gave a total of 216,317 lbs. which produced 66,855 lbs. of lint, a ginning out-turn of 30.9%. A comparative ginning test was carried out on the same day at the farm ginnery, which is fitted with Dobson & Barlow 40-Saw Brush Gins, and at the B.C.G.A. ginnery, Funtua, which is fitted with Murray air blast gins, to test the effect of the different types of gins on the quality of lint produced. The farm ginnery gave 31.83% lint while the Funtua ginnery gave 32.05%. A 5-lb. sample of lint from each ginnery was taken before baling and pressing, and sent home for broker's report, to be compared with the reports on lint taken from the bulk cotton in the bales to determine whether it is the Farm gins or the procedure followed at present of packing the lint from the gins into bags, which are then taken to Funtua and later pressed, that is the cause of the unsatisfactory features of the cotton from Daudawa, to which reference was made in last year's Report. The brokers' report suggested that the fault was probably attributable to the Farm gins, and consideration is being given to the steps that should be taken.

As "Strain L" has been condemned for future use as a pure strain owing to its susceptibility to leaf curl, the bulk of the seed was kept at Daudawa to be used for cattle feeding, but 30 tons were taken to Funtua where it was mixed with the ordinary seed for normal distribution, as it has many good points.

The strain that is being grown at Daudawa this year is K.1, a strain which has previously given good results on the drier sandier soils in and around Kano Province. The area under cotton on the Main Farm is 660 acres and on the Co-operative and Mixed Farms 170 acres.

In the past there has been no means of ascertaining the value of a selected strain as compared with the ordinary commercial cotton from the point of view of the yields at Daudawa. To rectify this it has now been decided to make every year a field comparison of the current strain with the ordinary cotton; the first experiment for this purpose has been laid out this year.

Another experiment is intended to test the value of ploughing as compared with careful cleaning before ridging. Ploughing on fields which waterlogged and were thought to be panned has apparently given good results, but definite proof has not so far been obtained. It is possible that the improvement in yield was at least partially due to the fact that the weeds were buried and the land left particularly clean, and not altogether to the direct effect of deep ploughing. This year a field has been laid out in 2-acre strips of each of the treatments

(i) land ploughed ; (ii) land kept clear of weeds, but not ploughed ; (iii) land treated by the ordinary cultural operations as practised on the rest of the farm.

Planting was commenced on the 30th June : the poorer fields in which the rock is very near the surface were planted first so as to give them as long a growing period as possible, in the hope that the yield might thus be increased. Seed supplies being ample, a seed rate of 6 or 7 lbs. per acre was used in the first sown fields, but a dry spell in early July made it necessary to curtail the seed rate slightly in case the fields sown directly before and at the beginning of the dry spell did not germinate well. These fears were unfounded, however, and germination was very good, with the result that a nice even stand was obtained. Cultivators were used for inter-row cleaning between the young crop prior to weeding, and this made the work of weeding much lighter than it could possibly have been without their use. Owing to the success of this implement, it was also used, when time permitted, following the P.I.K. plough, and prior to the final ridging up with the D.Y. plough. A locally made iron and a wooden cultivator, which were sent to Daudawa by the Agricultural Department for trial against the factory-made models, came in very useful for this work also.

Flowering commenced in early September and fruiting looks very promising at the time of writing (October). After a dry spell towards the end of September a few light showers fell in the second week of October and there is promise of moderately good yields. Some slight damage has been caused by stemborers, leaf spot and blackarm, but the most obvious damage is that done to the leaves by leaf-eating insects. Owing to the rather wet August and early September the drier, well-drained fields are much more advanced than the others.

Bullrush Millet.—This was taken as a catch crop on 100 acres of the cotton land. The growing conditions for millet in the early rains were remarkably good with the result that an extraordinarily high yield has been obtained, and as the facilities for storage are now satisfactory, the crop has been well saved. The average yield per acre over the whole area was 909.74 lbs.

Guinea-corn.—At the time of writing the 1933-34 Report the season's crop was not harvested. It was in no case grown as a straight crop, but was intercropped with millet, groundnuts and cotton. In the latter case it consisted of widely spaced plants left to mature after the silos were filled ; the average yield per acre of 305 lbs. was therefore quite satisfactory. In the current year 70 acres are being grown

as a straight crop, on 100 acres it is interplanted with groundnuts or green gram and on 60 acres it is spaced at 20 ft. between cotton. On 40 acres it was grown for ensilage between cotton; the bulk of this was used to fill the silos and the remainder for feeding in a green state to the cattle to replace the cottonseed which was almost used up at the time.

Green Gram.—About 9 acres of these are being grown in one of the groundnut fields. The seed and the plants will both be harvested, the seed will be used for sowing on the pasture fields and the haulms will be mixed with grass, etc. for hay.

Groundnuts.—The 80 acres of the previous season yielded 327 lbs. of unshelled nuts per acre, and, after seed had been retained, the remainder was sold at £5. 7s. 6d. per ton. This year 91 acres have been planted, all between guinea-corn as in the previous season. The haulms as usual will be saved for fodder.

Tobacco.—The area of 11 acres planted in this crop in 1934 yielded an average of 534 lbs. per acre of cured leaf. The bulk of the crop, some 4,994 lbs., was sold at 3d. per lb., and the remaining 882 lbs. composed mostly of bottom leaves was classed as No. 2. grade and brought 2d. per lb. On the whole the crop was a success.

This season, in spite of the fact that the first sowings were made on the 29th of May, it was not until early July that good germination was finally obtained, and though the seed beds were treated with liquid manure the plants were very late in reaching the transplanting stage. Some plants which had grown from the earlier sowings were planted out on the 18th and 26th of August and covered about 4 acres. These have come away well. The remaining area was planted in early and mid September. The early September plantings, amounting to 3 acres, have also established themselves, and though quite small yet, are very regular. The remaining 3 acres planted out in mid September suffered quite a lot from the dry spell which started soon after, and as a result are now very irregular. The showers in October have helped these later plantings very much and there is now hope of getting some crop, but yields will be low and the manurial trial useless.

Haygrass.—Another 20 acres were allowed to go to grass this year, this making a total now of 40 acres. These two fields have been so severely damaged by erosion that the cultivation of them had become very tedious and expensive. Wherever possible this grass is being cut with the mower and will be made into hay together with guinea-corn leaves, groundnut haulms and green gram, and stacked to be used for dry-season feeding.

CATTLE.

At the time of writing the last Report the herd had a strength of 167 head ; there is still need for more draft animals, but the scarcity of cattle for sale has rather held things up. The herd now stands at 187 beasts, as follows : 136 bulls and bullocks suitable for work ; 20 cows and heifers ; and 31 young stock including calves. As in the previous season, beasts bought during the current year are placed as a reserve herd for training next season. The deaths for the year were 19, from the following causes :—congestion of the lungs, 1 ; sclerosis of the liver, 6 ; trypanosomiasis, 1 ; septicaemia, 1 ; shock following injection, 1 ; rinderpest, 6 ; vegetable poisoning, 1 ; chronic peritonitis, 1 ; drowned, 1. Extensive clearing of tsetse areas in the locality has been carried out, and there is no doubt that this is largely responsible for the improvement in the health of the herd.

Another 190 acres of the Farm received a dressing of 2 tons per acre of farmyard manure.

LABOUR.

Male labour has been rather scarce throughout the year, and the number of women and children employed has shown an increase. The greater part of the cultivation is, however, now done entirely by cattle, except for the processes which must be done by hand, which include sowing, weeding, thinning and supplying. These do not call for skilled labour, however, and women and children have actually been found more satisfactory than men, as they are more painstaking. The use of cattle has thus made the farm less dependent on the supply of labour available.

An interesting experiment has been tried to see if one man and a pair of cattle are capable of doing all the work on a field of 20 acres of cotton. The result has proved beyond a doubt that such an area is too large for him : he was capable of doing all the cattle work necessary, but was unable to cope with the planting, weeding, thinning or re-sowing. Weeding alone of 20 acres of cotton takes roughly 90 man-days, and it is therefore easy to see why one man could not compete with it. When the work in the cotton fields was finished in October, these men were given work elsewhere until picking time, as the fields they had been working had proved by far the most expensively worked fields on the farm.

Health has been quite good and there have been no outbreaks of infectious disease.

CO-OPERATIVE AND MIXED FARMS.

This year has seen the commencement of the new scheme of establishing Mixed Farmers on a portion of the main farm. To start

the scheme two men were supplied by the Agricultural Department, and each of these was set up with a holding of 10 acres, on which dwelling houses and cattle sheds were built; each was also supplied with a pair of trained working beasts and a D.Y. plough. A part of the cost of the clearing, and the cost of the houses, stock and implements are to be paid back by these men by instalments, either by payments for services or out of the proceeds from the sale of their crops, including cotton which is the same strain as that grown on the rest of the farm, and will therefore be bought by the Corporation. These men are now well established and are more than satisfied with their lot. They both have their work finished in good time and each has 7 acres of cotton besides an ample supply of cereals for food for themselves and their cattle for the coming year.

Last year the Co-operative Farmers had 130 acres under cotton and produced 30,544 lbs. of grade 1. seed cotton, which was, as usual, bought by the Corporation, the price being 1.1d.—1.2d. per lb. This year their estimated area under cotton is 156 acres and it is all K.1, which is the strain grown on the Main Farm this year.

WATER-WORKS.

Two wells have been sunk, one at a cattle camp on the south side of the farm, and the other below the main labour camp. Both are a success and have been lined with concrete.

BUILDINGS.

Owing to the lack of good dry accommodation which in the past had a serious effect on the health of the cattle herd, it was decided to build permanent cattle pens with lean-to pan roofs covering about one third of the pen on the weather side, to be built in pairs end on for the sake of economy in materials and labour. The first pair were started this year, but at the time of writing are not quite finished. The covered space in each pen is roughly 15 yards by 7 yards, while the uncovered part is 15 yards by 12 yards. The whole is surrounded by concrete pillars to which the railings are bolted for convenience of replacement. These pens are strongly made and should last indefinitely, supplying a long-felt need for dry housing for the working cattle in the wet season, and replacing the old bush wood pens which were so costly to maintain and provided such poor shelter from the weather. A mud walled silo has also been built.

LOCUSTS.

Large flights of locusts came over early in April and passed without settling on the farm. Considerable damage was done in Funtua district by hoppers, but none were seen in this neighbourhood.

METEOROLOGICAL DATA, 1935.

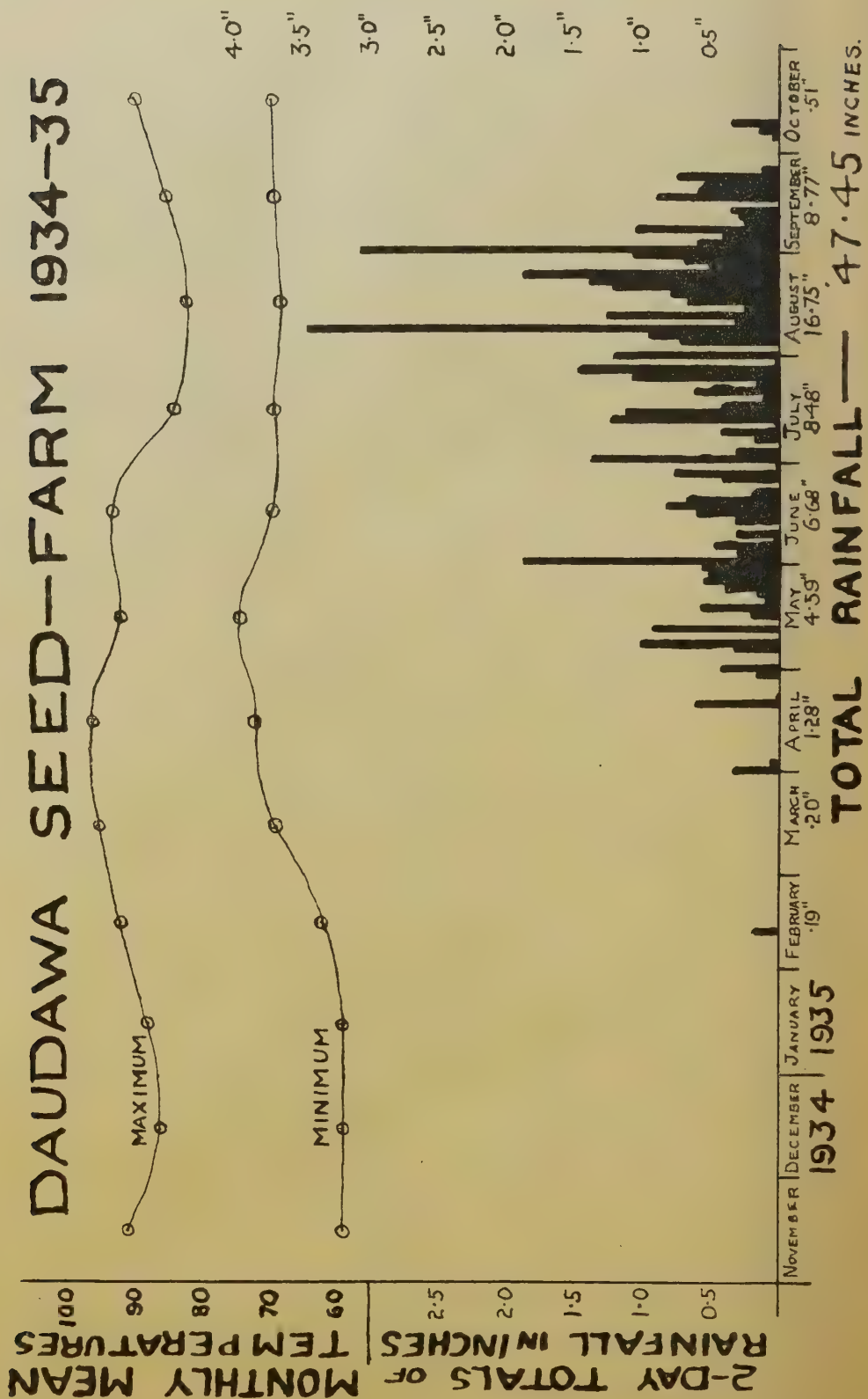
The occurrence of an entirely unexpected rain and wind storm on the 11th of February did considerable damage to the open cotton bolls; this appears to be the first of its kind at this period within memory. The true rains commenced on the 31st March, and the last rain fell on October 9th. Throughout late July, August and the first three weeks of September rain was rather too abundant to provide optimum growing conditions for cotton, but suited the cereal crops quite well.

GENERAL.

The thanks of the Corporation and of the staff at Daudawa are tendered to the officers of the Administrative, Agricultural and Veterinary Departments for their continued help and co-operation during the year.

NIGERIA

DAUDAWA SEED-FARM 1934-35

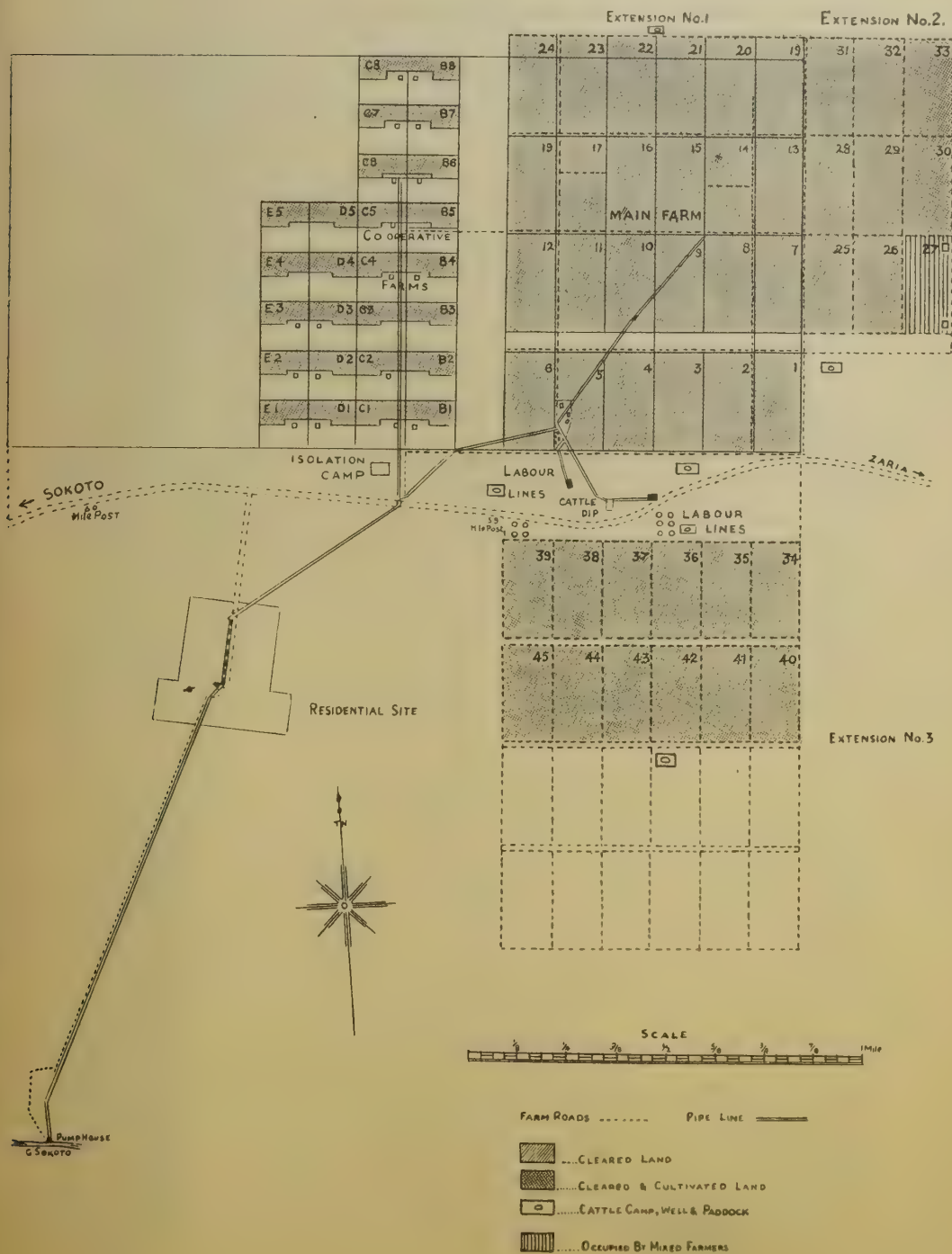


TOTAL RAINFALL—47.45 INCHES.

NIGERIA

DAUDAWA SEED-FARM, NORTHERN NIGERIA, 1935.

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[Included by courtesy of the Nigerian Government.]

NIGERIA.

PROGRESS REPORT ON WORK ON COTTON IN THE NORTHERN PROVINCES FOR THE SEASON, 1934-35.

BY

J. K. MAYO.

ZARIA.

The weather during the 1934-35 season was favourable for yield in most places owing to light rains in September and two heavy showers in October. It also appears to have favoured stainers and the crop as a whole was slightly more stained than usual. The rainfall diagram is practically the same as that published with the Daudawa report. Selection work in the local cotton (derived from Allen which was introduced in 1912) has been continued, aiming mainly at increased yield without losing quality. Strain L which was selected for quality and had given superior lint and equal yield to the local cotton for 2 or 3 years gave inferior yields in 1933-34 and in the present season 1934-35. This was due to increased damage from Leaf Curl and from jassids. The three strains selected primarily for yield, on the other hand, were more resistant to Leaf Curl and jassid than the ordinary commercial cotton. The following are the figures obtained from two yield trials situated 3 miles apart:—

BOMO YIELD TRIAL 1934-35.

16 $\frac{1}{2}$ -acre plots Commercial Cotton.

5 " " of each variety.

Variety.	Average number of plants per plot.	Average number of plants damaged by Leaf Curl.	% damaged by Leaf Curl.
Commercial Cotton	937	133	14.2
K.1	953	95	10.0
L	858	167	19.5
D-31	927	17	1.8

SAMARU (SMALL SCALE) YIELD TRIAL 1934-35.

Randomised Blocks.

9 plots of each variety.

Variety.	Total number of plants.	Total number of plants damaged by Leaf Curl.	% Leaf Curl.
Commercial Cotton	776	113	14.6
K.1	779	98	12.6
L	775	205	26.4
11	779	146	18.7
C.31	775	109	14.1
4	776	45	5.8
5	772	16	2.1

NOTE.—11 is a selection from S.G.27 (introduced from Uganda).

4 „ „ „ D-31.

5 „ „ „ E-31.

K.1 is an old selection from the local cotton and is the standard cotton in Kano Province. C-31, D-31 and E-31 are the three strains selected from some 50 others in 1932 which were derived from field selections made in 1931. None of the 16 infected plants of variety 5 was seriously damaged by the disease and it may be considered to be almost immune.

The yields in the above trials were as follows :—

BOMO YIELD TRIAL 1934-35.

<i>Variety.</i>	<i>Yield of Seed Cotton.</i>	<i>Standard error.</i>	<i>Yield as percentage of standard.</i>
Commercial Cotton	242 lbs. per acre	± 33	100
K.1	245 „ „ „	± 33	101
L	134 „ „ „	± 33	55
D-31	308 „ „ „	± 33	127

The ginning percentages were not reliable, but it was known from previous experiments that commercial cotton, K.1, and L usually give percentages varying from 30 to 31 while D-31 gives 32 to 35%.

SAMARU (SMALL SCALE) YIELD TRIAL 1934-35.
Randomised Blocks.

<i>Variety.</i>	<i>Yield of Lint per acre.</i>	<i>Yield as % of standard.</i>	<i>Signif. Diffce. @ .05 Probability</i>
Commercial Cotton	149	100	15.6
K.1	161	108	—
L	124	82.9	—
11	138	92.5	—
C-31	180	120.8	—
4	172	115.7	—
5	170	114.1	—

The differences of L, C-31, and 4 were significant.

D-31 was tested also at Gusau in Sokoto Province which is 100 miles to the N.W. of Zaria, and at Kano which is 100 miles to the N.E. of Zaria. At both places it gave significant increases in yield of seed cotton—17% at Gusau and 50% at Kano. To this must be added the advantage of its higher ginning percentage.

All the above varieties (except L) from the four Yield Trials were sent to the Shirley Institute for spinning tests. The D-31 samples all gave rather weaker yarns than the ordinary cotton, but K.1 was very similar to it. The D-31, C-31 and E-31 seed used for these trials had been selfed for only one generation since it was selected from the field ; C-31 and E-31 seem to have been pure for most characters when selected, but D-31 is very far from pure and numerous selections have been made in it. There is some hope of bringing the quality up to that of the local cotton.

In addition to this work 195 hybrid strains supplied by Dr. Harland from Trinidad were grown in 1934-35. The yield figures were better than they promised to be, and it is clear that jassids are far less serious a pest here than in some other parts of Africa, as some of the less hairy A F B strains gave fair yields though there was a normal infestation of jassids at Zaria.

YANDEV.

There is a large tract of country sometimes described as the " middle belt " which includes Ilorin, Kabba, Benue and the Southern part of Niger Provinces in which frequent unsuccessful attempts have been made to foster the growing of cotton and to replace the local variety (*G. vitifolium*) with a better one, either by introduction from other countries or by selection in the local variety. The difficulties in the way are the variability of the seasons, the prevalence of stainers, and the native practice of planting cotton on the yam heaps. Occasionally jassids become a major pest. Experimental work has been confined to Yandev, 50 miles S.E. from Makurdi, and in 1934-35 there were two (inconclusive) yield trials of local strains, some of which were sent for a spinning test, and 60 of Dr. Harland's strains were grown from spare seed from the Zaria experiment. The failure of these strains at Yandev can be attributed entirely to stainers. It is clear from the fact that A F B 45 gave the highest yield of this lot that jassids were of no account at Yandev in 1934.

PROGRESS REPORT OF COTTON SELECTION WORK AT MOOR PLANTATION, IBADAN, SEASON 1934-35.

BY

E. H. G. SMITH.

As this is the first report from Ibadan included in this annual review, it is perhaps useful to summarize the history of cotton selection in Southern Nigeria. Moor Plantation is the principal agricultural experiment station in the South, and the organisation of the station includes a botanical (plant breeding) section, which deals with plant selection in Southern Nigeria. Cotton is among the several crops studied by this section.

While certain other provinces grow a little cotton, the two Western Provinces of Oyo and Abeokuta include the important cotton-growing districts. Originally, a variety of *Gossypium peruvianum*, locally known as Native cotton, was exploited exclusively here, and this variety still persists in certain more remote districts where there is a local weaving industry. After extensive trials of the latter cotton, of Allen (*G. hirsutum*), and of Ishan (according to Dr. Harland a variety of *G. barbadense*), improved Ishan strain A was first distributed to the cotton farmers in 1927, and is now, with the above mentioned exception, grown exclusively. Ishan A was the most satisfactory of a number of strains bred up by Mr. C. J. Lewin, the original material having been obtained from the Ishan Division of Benin Province. Thus Ishan cotton has long been grown in Southern Nigeria, but not in the important commercial areas.

At the present time, two lines of work are being followed :—Firstly, the maintenance of the present variety (improved Ishan strain A), secondly, a search for further improvement. Ishan A is maintained by annual single plant re-selection, and each year a quantity of fresh seed passes from the plant breeder to the agriculturalist. Under the latter, the new seed is taken through a multiplication programme, which has been described by Lewin*. As regards the second line of work, Ishan A is in most respects a very satisfactory cotton, but the roughness of the lint is an undesirable feature. Acting on Dr. Harland's advice, an attempt is being made to graft the smooth lint character of Sea Island cotton on to Ishan A. These two cottons have been crossed, and the F_1 has been back-crossed with Ishan A for both one and two generations. Much of the crossing and back-crossing has been carried out at the Corporation's station in St. Vincent, and at the same time this work has been duplicated in Nigeria.

The 1934–35 Ibadan cotton season was somewhat disappointing, and was abnormal in that the usual break in the rains during the growing period did not occur. Rainfall for the period July to October was well above average as follows :—

MONTHLY RAINFALL IN INCHES.

	Average 21 years.	1934.
July	6.23	8.11
August	3.19	6.40
September	7.27	7.89
October	6.56	7.68

* The maintenance of purity of cotton strains under distribution to peasant farmers, with special reference to Southern Nigeria—Conference on cotton growing problems—1930.

Cotton at Ibadan is sown about July 1st, some three months after the first rains begin. There is usually a break in the rains, known as the short dry season, which extends for about three weeks, and which may occur at any time between the last week of July and the end of August; June, July, September and October normally being months of heavy rainfall. The August break in the rains occasions a check in the development of the cotton plants. Serious flowering begins during October, the last month of appreciable rainfall, and the flowering peak is reached from about the middle of November to early December. It is usual for severe shedding of buds and bolls to occur until heavy rain ceases. In 1934, as a result of the absence of a check in growth during August, the cotton was very forward by the end of September, and the flowering peak was reached towards the end of October, fully two to three weeks before the usual time. The wet conditions also favoured the incidence of bacterial disease (*Pseudomonas malvacearum*) which appears to be largely controlled at Ibadan by climatic factors. As a result of the heavy rainfall, of the prevalence of bacterial disease, and possibly because the plot of land was rather below average fertility, loss of potential crop was severe. The loss of crop extended into November, right past the peak of flower production. The plants were of reasonable size, and should have carried a fair crop, but this had been largely lost, especially from the primary fruiting branches. Consequently, yields were low and irregular.

The re-selection of improved Ishan strain A followed the normal course, and was handicapped only by the poor yields described above. On account of these yields it was necessary to select two single plants in the place of one only which is the general practice. The measurable characters of Ishan A are appended:—

(i) Selected Single Plant.

Measurable Characters.	1934-35.		1933-34.	1932-33.
	No. 1.	No. 2.		
Halo length (mm.)	34.3	32.3	29.5	30.5
Ginning percentage	34.4	35.6	37.0	35.5
Number of bolls	83	61	102	68
Weight of seed cotton (gms.)	82	75	217	90
Wt. of seed cotton per boll (gms.)	0.99	1.23	2.13	1.32

(ii) Average of all plants examined.

Measurable Characters.	1934-35.	1933-34.	1932-33.
Halo length (mm.)	30.9	29.7	30.0
Ginning percentage	33.6	36.6	34.5
Number of bolls per plant	44.0	58.4	104
Wt. of seed cotton per plant (gms.)	46.0	98.2	222
Wt. of seed cotton per boll (gms.)	1.04	1.7	2.1
Node of first fruiting branch	15.0	14.9	13.6

Single rows of Ishan strain E, one of Lewin's original selections, with good lint but susceptible to leaf curl, and of Ishan strains Q and X were grown for maintenance purposes. Strains Q and X were produced from the cross $A \times E$.

A comparatively large number of Ishan $A \times$ Sea Island first backcross progenies were under trial, these resulted from the cross $(A \times SI) \times A$. Of these twenty-eight single plant lots had been received from the Corporation's station in St. Vincent, and five had been produced locally. The St. Vincent cottons were denoted as ASTD, and the local cottons as AS. Considering the strains, the following classification was made on the smoothness of lint character :—

Best —Nos. ASTD 1, 9, 36, 47, 55, 101, 102 and 131.

Next best—Nos. ASTD 15, 25, 29, 41, 54, 85, 86 and 116.

Nos. AS 7, 28 and 77.

Rough —Nos. ASTD 10, 44, 68, 97, 117, 132, 144 and 150.

Nos. AS 47 and 75.

Very rough—Nos. ASTD 142, 148, 153 and 158.

As it would have been quite impracticable to deal individually with the mass of plants grown, the following procedure was adopted. In October a strict field classification was made of all the backcross strains on vegetative characters, and a reasonable number of plants were selected. On each of these more promising plants a few flowers were self-fertilized, so that sufficient selfed seed for a progeny row would be available. In connection with this field selection, it should be noted that there was an almost complete absence of jassid infestation until quite late in the season; thus the question of the resistance or susceptibility of these strains to jassid (an important point) was not brought out in 1934. When a sufficient number of bolls had opened, a second field selection was made, but based on the smoothness of lint character. Bearing in mind the position of the strains as regards smoothness of lint, twenty-six final selections were made from among the plants of which selfed seed was available—all the selfed plants being those considered most satisfactory on vegetative characters. Halo length was measured for all selections, and ginning percentage was tested where possible; but these observations were mainly for record purposes, selection having been based primarily on the smooth lint character, but within the plants most satisfactory on vegetative characters. Yield could not be accurately assessed, as harvesting was not carried out systematically, but the general unevenness of the cotton stand would have vitiated yield conclusions based on last season's results. Twenty-one of the selections were from the St. Vincent strains, and five from the local backcrosses.

In addition to the above, a number of second generation backcrosses, produced by the crossing $[(A \times SI) \times A] \times A$, were grown, these had all been produced locally. Five selections were made for next season, but none appeared likely to prove entirely satisfactory in lint character.

The rough lint character appears to be very persistent in all backcrosses of Ishan A; this was noticed in the examination of the first backcrosses, but was even more marked in the second. In fact, roughness of lint appears to be associated with the desired vegetative characters, a strong, vigorous, late flowering and hairy plant, while on the other hand many of the finer lints were found associated with the opposite vegetative characters. Ishan A has primarily succeeded in Southern Nigeria on account of its vegetative suitability. An original and fine linted sister strain (Ishan E) had to be discarded on account of leaf curl, and was also susceptible to jassid attack. Any new strain that is to have a chance of replacing Ishan A must succeed on agricultural characteristics, including high yield when intercropped, and resistance to pests and disease. To issue a new cotton without such features would be to court endless trouble.

A few rows of Dr. Harland's cotton hybrids were also grown for observation, these were all of *hirsutum* type, and quite unsuited to Southern Nigeria.

WEST INDIES.

COTTON EXPERIMENT STATION, ST. VINCENT,
PROGRESS REPORT FOR THE SEASON 1934-35.

BY

S. H. EVELYN.

1. *Experiments With Sea Island Cottons.*

(a) *St. Vincent Commercial Superfine* (V.135).—In continuation of our annual practice of supplying commercial growers with seed one year removed from selfing, 452 lbs. of self-fertilized pure line V.135 seed was produced at the Station this season and will be multiplied in the season 1935-36 on a local estate. Each season the Station's multiplication plot of pure V.135 is planted with selfed seed of the six highest bolling plants selected from the preceding season's multiplication area. This year's six selections ranged in number of bolls from 178 to 240.

Two strains with extra long staple (62 mm.) were grown in pedigree culture. Although one of the plants produced a mean lint length of 63 mm. it was decided, in view of the purity of V.135 for this character, to discontinue selecting for extra long staple and to concentrate on such characters as lint index, ginning percentage and bolling. The two selections made this season have been chosen with this object in view.

The significant negative correlation established last year between node and number of main axis bolls per tree in V.135 was investigated. Selections varying in their node number from 8 to 15 and in number of main axis bolls from 20 to 120 were grown in progeny rows and observed for node number and bolling. Although the correlation between node number and bolling of the progeny was again of high negative significance, no relation was found between parents and offspring for the characters node number or number of main axis bolls per tree. The correlation is thus physiological and not genetic.

(b) *Red Sea Island (R.S.I.)*.—The gene R^2 (red plant body—weak spot) having now been successfully transferred from the Trinidad Red Kidney tree cotton to Sea Island V.135, attention was directed this season towards the improvement of this new synthesized type. Twenty-seven selections for bolling, lint length, and lint index were grown in progeny rows and although superior to V.135 in weights of seed cotton and lint per boll, lint index and ginning percentage, they produced,

in general, fewer bolls per tree. Many individual plants, however, produced between 90 and 100 main axis bolls and the best of these are included in the forty-one selections made for next season's work.

A 6th backcross (Trinidad Red Kidney $\times$ Sea Island) $\times$ V.135 was grown this season. It was decided from the results of its analysis to discontinue backcrossing. A single outstanding red plant of this backcross which produced 187 bolls was retained for observation in progeny rows next season.

A yield test carried out this season between Red Sea Island and V.135 was significantly in favour of the latter. An analysis of the factors responsible showed that the higher yield of V.135 was due to its higher number of bolls per tree. The difference in yield, although significant, was not very great. The yield of lint estimated per acre was 616.9 lbs. for Red Sea Island and 626.4 lbs. for V.135.

Lint samples of the two strains were submitted for spinning tests and brokers' valuation. The detailed spinning test report states that both samples were very neppy and that it was found necessary to strip the card once every hour during the running of them. In strength and appearance V.135 was superior to Red Sea Island, although the samples gave practically identical results in the hair tests, and, compared with V.135 tested in 1932, were slightly longer, contained fewer dead hairs but had about the same hair-weight per centimetre. Spinning was good in 150's for both samples, but breakages were rather numerous in 200's.

The brokers' report was as follows :—

Type of Cotton.	Grade and Remarks on Colour.	Length of Staple.	Strength of Staple.	Quality and Character of Staple.	Value Pence per lb.
V.135	Bright good colour	2"	Strong ...	Fine and lustrous ...	17-00d.
R.S.I.	Bright rather high colour	2" but rather irregular	Medium...	Rather wanting in fineness as compared with best Sea Island	13-00d. to 14-00d. nom.

It should be mentioned that owing to a shortage of seed of the best Red Sea Island strain the seed of many such strains had to be mixed to give enough for the experiment.

(c) *An Experiment to combine the Lint Characters of V.135 with the High Yield of Montserrat Sea Island (M.S.I.)*—Five selections from a selfed first backcross, and two from a selfed second backcross of (M.S.I. $\times$ V.135) $\times$ M.S.I. combining the V.135 lint length with lint indexes ranging from 49 to 59 mg., and ginning percentages ranging from 27.2 to 31.1 were grown this season. The mean loculi values

of each of the progeny rows of the five selections were identical with that of the Montserrat parent (3.5) and those of the progeny of the two selfed second backcross families were intermediate between the two parents (3.3). The mean loculi value of V.135 is 3.1.

Three of the five selfed first backcross selections bred true to V.135 length and the four remaining selections, although heterozygous, had mean lengths nearer the V.135 parent. It would appear from this season's results that the object of this experiment is nearing attainment and next season 57 selections combining V.135 length with high lint index, high ginning percentage or high lint per boll will be grown in progeny rows and intensively examined.

(d) *Studies of the Relations of Corolla Colours in Sea Island Strains.*

Three major grades of corolla colour occur in Sea Island cottons and are represented by the strains AN (Yellow—grade 8), BD (Pale yellow—grade 6), and S.I.W. (Cream—grade 2). The last named, which is locally designated "Sea Island White," is a mutant out of AN and has no leaf callus spot.

Employing the repeated backcross technique, a study is being made of the inter-relation between these corolla colours and between them and the characters corolla spot, leaf callus spot, lint length, lint index, etc.

This season 120 plants of a first backcross ($AN \times S.I.W.$) $\times$ S.I.W. and four F_1 plants of the crosses ($AN \times BD$) and ($BD \times S.I.W.$) were grown.

The results to date can be seen from the following table:—

<i>F₁'s and 1st Backcross</i>	COROLLA COLOUR GRADE.			
	2	5	6	8
(AN $\times$ S.I.W.) F_1	—	—	—	4
(AN $\times$ BD) F_1	—	—	4	—
(BD $\times$ S.I.W.) F_1	—	4	—	—
(AN $\times$ S.I.W.) $\times$ S.I.W.	60	—	19	41

In the first backcross ($AN \times S.I.W.$) $\times$ S.I.W. no significant relation was found between corolla colour and the characters callus spot, lint length, lint index, seed weight, ginning percentage, or loculi per boll, but a highly significant relation was established between corolla colour and corolla spot. The mean spot grade for Yellow (Y) plants was 16.22 and that for Cream (y) plants was 12.97.

Seven families of a second backcross ($AN \times S.I.W.$) $\times$ S.I.W. and a single family of each of the first backcrosses ($AN \times BD$) $\times$ AN, ($AN \times BD$) $\times$ BD, and ($BD \times S.I.W.$) $\times$ S.I.W. will be grown next season.

2. *Experiments with Perennial Tree Cottons (Moco, Marie Galante, Antilles).*

Straight selection and backcrossing were continued with the above types with the object of producing either (a) a Moco, or (b) a Moco in combination with Marie Galante or Antilles, which could replace the existing Marie Galante types in cultivation in the drier Grenadines.

So far the weakness of Moco lint still makes this type undesirable—although strains free from the naked gene and pure for 47–48 mm. length are now available. Eighteen Moco selections were grown this season, but only two of these were considered to merit further study. None of the strains was sufficiently hairy to be of value in jassid-infested areas.

Ten tufted plants were selected from a family, heterozygous for tufted, and grown this season in progeny rows for tuft grade observations. Four families bred true to tufted. The following are the results for the six heterozygous families:—

<i>Family.</i>	<i>Population.</i>	<i>Tufted.</i>	<i>Naked.</i>
M.1-1-8-9- 4	18	14	4
- 7	20	15	5
- 8	19	18	1
- 9	18	12	6
-10	20	16	4
-15	19	16	3
TOTALS	114	91	23

From the above it can be concluded that the naked gene 't' in Moco Bourbons is a simple recessive.

Slight promise was shown by (Moco $\times$ Marie Galante) F_3 selections, and the two best F_4 plants will be grown in progeny rows next season.

A first backcross (Moco $\times$ Antilles) $\times$ Moco was made this season. The F_1 of this cross appears to be promising.

Samples of eight substrains of Antilles were submitted to the Shirley Institute, and bale lots of the same substrains were sent for sale and commercial testing. The Reports on the small samples were not so satisfactory as those received last season, but a better preliminary report has been obtained on the bale lots.

3. *Experiments with Ishan Cotton from Nigeria.*

As stated last year, the object of this experiment is to try to improve the fineness and lint length of Ishan by crossing with Sea Island (V.135). The material under discussion is the selfed first backcross (Ishan $\times$ V.135) $\times$ Ishan. Eighteen selections combining long fine lint with other desirable characters were grown in progeny rows this season. The

majority of the progeny were markedly superior to Ishan in all lint and seed characters and in many cases showed a higher resistance to Angular Leaf Spot. Sixty-three selections have now been made, most of which combine long fine lint with high values for lint index, ginning percentage, or lint per boll. Strains resistant and susceptible to Angular Leaf Spot and to Black Scale are also being studied. Selfed seeds of the most promising strains were sent to Nigeria at the end of the season.

A selfed reciprocal backcross ($\text{Ishan} \times \text{V.135}$) $\times$ V.135 was discarded at the end of this season as it was much inferior to the above material.

A first backcross, ($\text{Red Sea Island} \times \text{Ishan}$) $\times$ Ishan, was made this season. The Red Sea Island strains are in general highly resistant to Angular Leaf Spot. The F_1 of the cross gave very promising results.

4. *Experiments with U.4 in Combination with Other Types.*

(a) *U.4 Types containing the Asiatic Red Gene.*—As a result of repeated backcrossing of New World (*G. barbadense* L. (Sea Island-Egyptian) $\times$ Asiatic red-flowered *G. arboreum* to New World cottons, it has been found possible to transfer the red gene from Asiatic to U.4. Seventeen selections of a fourth backcross (selfed three times) were grown this season. These selections (R.U.4) were chosen for lint length (42–46 mm.), lint index (60–67 mg.), ginning outturn (38–39%), bolling 150–160), and hairiness. Among the outstanding characters exhibited by the progeny of these selections were their very early maturity and almost complete immunity to Angular Leaf Spot disease. The former character, doubtless derived from the Asiatic parent, was demonstrated by a plant that flowered at 48 days, split its first boll 35 days after, and matured its total crop of 56 bolls in 96 days from the date it was sown. In some cases boll-splitting occurred as early as 27 days after flowering. The R.U.4 strains, when compared with Parnell's standard U.4. grown here this season, are earlier maturing and combine a longer staple with higher weights of lint and seed cotton per boll. Another important character exhibited by these strains and probably inherited from their Sea Island-Egyptian parent, is that of clean seeds. Six families carried this gene in a heterozygous condition. Higher values were obtained for all characters on which selection was based last season. The maxima for lint length, lint index and ginning outturn were 48 mm., 76 mg., and 42.7% respectively. Fifty-four selections will be grown in progeny rows next season for intensive examination. Seeds of this season's earliest

maturing strains have been sent to Rhodesia, Nyasaland, the Sudan and Indore for trial.

(b) *U.4 and Cambodia in Combination with a Bourbon Type*.—Five F_2 selections from the crosses (U.4 $\times$ Bourbon Intense Spot) and (Cambodia $\times$ Bourbon Intense Spot) were grown this season and observed for lint length, hairiness, general characters and resistance to pests. Five plants produced mean lint lengths of 46 mm. and over, and these will be grown next season. In general, the bearing was good and some of the plants were clean-seeded. The plants were attacked by aphid in the early stages, but soon recovered. Segregation for resistance to Black Scale was observed.

5. *To produce a New World Cotton Carrying Asiatic Red Pigment.*

Four hundred and fifty plants of a fifth backcross, (Asiatic Red $\times$ New World) $\times$ T.57 (Upland Big Boll), were grown this season, and observations for earliness, flower characters, bolling and hairiness were recorded. Of this number 239 were red flowered and 211 cream flowered. The plants were phenotypically Upland in character, many were quite hairy and some were earlier maturing than standard Uplands. One plant flowered 51 days after sowing and split its first boll 28 days later. The three red plants to flower earliest and the ten highest bolling red plants will be grown in progeny rows next season.

A sixth backcross to Type 57 was made.

6. *Miscellaneous.*

(a) Investigations into the genetic behaviour of the characters boll locus, kidneying, and motes were undertaken. The genetics of a semi-sterile mutant of V.135 was also investigated. Further data are required before a discussion of these studies can be made.

(b) Four F_1 selections of *G. Trilobum* δ in combination with V.135, Red Sea Island, Montserrat Sea Island, and Punjab Golden were grown. These were all self-sterile and backcrossing was unsuccessful.

(c) Twenty-eight F_1 selections, on which linkage studies are being investigated, were sent from the Trinidad Stations for the purpose of obtaining selfed seed which, on account of pest damage, is almost impossible in open fields in Trinidad. Flower characters were recorded for each plant.

(d) One hundred and eighty miscellaneous cotton types were maintained in pure culture. A series of Sea Island strains varying in lint length from 48 mm. to 62 mm. was also maintained.

[Included by courtesy of the Fiji Government.]

FIJI

COTTON EXPERIMENT STATION, SIGATOKA, PROGRESS REPORT FOR THE SEASON 1934-35.

BY

D. A. DONALD.

The cotton planting season was well advanced before permission was granted to distribute seed for planting a crop for which the Government are, at present, the only purchasers. The planting programme was consequently heavily curtailed and was further restricted by the unusually long dry spell of weather which continued in the cotton-growing areas right up to early January, and then the jassid pest proved very destructive.

These two factors combined to reduce the area actually planted to approximately 230 acres, while the continuance of further unfavourable weather led to poor cropping which culminated in wet weather during the picking season, so that poor conditions dogged the industry right through the season and it is unlikely that the total crop will exceed 30-40 bales, of which approximately half is Sea Island cotton.

The succession of unfavourable circumstances during the season rendered most of the experimental work of little value. Moreover, the Corporation's Officer in charge of the experiments left the Colony during the season on transfer to the Sudan so that results have not been fully tabulated.

With reference to selection work, 89 single plant selections were made from the F_4 generation of the double backcross from plants which, in the previous season, had been self fertilised. Of these 44 proved to be recessives and 45 dominants for the recorded characters.

In selection work much importance has been attached to the erect and compact habit of prolifically bearing plants and to resistance to attacks by Blackarm and jassid.

The seed cotton from selected plants is subjected to numerous tests including the determination of lint index, ginning percentage, weight of seed cotton per boll, number of bolls per plant, lint length, lint colour, general uniformity of staple, amount of "nep", fineness and strength of the staple and other characters.

A satisfactory report was received from the Empire Cotton Growing Corporation on the best F_4 samples of Fiji backcross which were forwarded for examination early in the year.

The report indicates also that the Sakel×Sea Island hybrid was considered a fairly good cotton of the Sakel class and that it would find a market amongst Sakel spinners, its valuation being only 50 points off first quality Sudan Sakel.

The cotton problem in Fiji consists in inducing Fijians and Indians who are situated outside the sugar cane areas to plant cotton, which, while it gives quite useful returns to the grower, cannot compete with the higher and more certain remuneration which is derived by growing sugar cane.

Nevertheless, the Indian population is steadily increasing and there is abundant evidence that Indians are anxious to find remunerative crops other than sugar cane, since the areas available to them are now largely situated outside the sugar cane lands.

Hence a special effort is being made next season to stimulate cotton cultivation and it is expected that, if seasonable weather is experienced, some 150 bales of Sea Island cotton and 300 bales of Fiji backcross No. 172, will be produced.

In addition, spacing, rotation, and cultivation experiments are being laid down with the backcross No. 172, which appears to be a good type of marketable cotton comparable to fully good fair Sakel.

EMPIRE COTTON GROWING CORPORATION

King's Buildings, Dean Stanley St., Millbank, London, S.W.1.

List of Publications issued to date. Those still in print can be obtained direct from the Corporation at the above address.

- "Cotton Growing within the British Empire and The World's Capacity for Consuming Cotton Goods." J. W. McConnel. 1921. Price 2s., post free.
- "Cotton Growing in Nigeria." Sir Hector Duff. Price 2s., post free.
- "The Extension of Cotton Cultivation in Tanganyika Territory." Major Hastings Horne. 1922. Price 2s., post free.
- * "Cotton Cultivation in Nyasaland." H. C. Sampson. 1922.
- "Cotton Growing in South Africa." G. F. Keatinge. 1923. Price 2s., post free.
- * "Cotton Growing within the British Empire." L. G. Killby. 1924.
- "A Cotton Research Station for the British Empire." Professor J. B. Farmer and Mr. L. G. Killby. 1925. Price 2s., post free.
- "Report on the Cotton-Growing Industry in Uganda, Kenya, and the Mwanza District of Tanganyika." Col. C. N. French. 1925. Price 1s. 3d., post free.
- "Reports received from Experiment Stations for the Seasons 1923, 1924, and (South Africa only) 1925." Price 2s., post free.
- "Memorandum by the Mechanical Transport Sub-Committee." Mr. G. H. Baillie, Mr. R. H. Brackenbury, Col. C. N. French. 1925. Price 2s., post free.
- "Report on the Cotton-Growing Industry of Nigeria, 1926." Col. C. N. French. 1926. Price 2s., post free.
- * "The Principles and Practice of Yield Trials." F. L. Engledow and G. Udny Yule. 1926.

* Out of print.

List of Publications—Continued.

- “ Reports received from Experiment Stations, 1925-26.” Price **2s. 6d.**, post free.
- “ Report on Suitable Rotation Crops for Cotton.” H. C. Sampson. 1927. Price **1s.**, post free.
- “ Cotton Growing in Southern Africa and the Rhodesias.” Report on a Tour undertaken by Sir James Currie, Mr. J. S. Addison, and Mr. H. C. Jefferys. 1927. Price **2s.**, post free.
- “ Reports received from Experiment Stations, 1926-27.” Price **2s. 6d.**, post free.
- * “ Reports from Turkestan Plant Breeding Station, Tashkent.” 1928.
- “ Review of the Situation in the Principal Cotton-Growing Territories of the Empire, and a Summary of the Main Activities of the Corporation since their Formation.” 1928. Price **6d.**, postage extra.
- “ Report on Cotton Breeding and Seed Supply in Nigeria, 1928.” F. L. Engledow and C. N. French. Price **2s.**, post free.
- * “ Memoirs of the Cotton Research Station, Trinidad.” Series B. Physiology. No. 1. Studies on the Transport of Carbohydrates in the Cotton Plant. Parts I. and II. T. G. Mason and E. J. Maskell. 1928.
- “ Reports received from Experiment Stations, 1927-28.” Price **2s. 6d.**, post free.
- “ Memoirs of the Cotton Research Station, Trinidad.” Series A. Genetics. No. 1. The Inheritance of (i) Petal Spot, (ii) Pollen Colour, (iii) Corolla Colour. S. C. Harland. 1929. Price **2s. 6d.**, post free.
- “ Reports received from Experiment Stations, 1928-29.” Price **2s. 6d.**, post free.
- * “ Memoirs of the Cotton Research Station, Trinidad.” Series B. Physiology. No. 2. Studies on the Transport of Nitrogenous Substances in the Cotton Plant. Parts I., II. and III. E. J. Maskell and T. G. Mason. 1930.
- “ Memoirs of the Cotton Research Station, Trinidad.” Series B. Physiology. No. 3. Studies on the Transport of Nitrogenous Substances in the Cotton Plant. Parts IV. and V. E. J. Maskell and T. G. Mason. 1930. Price **2s. 6d.**, post free.
- “ Conference of Workers on Cotton Growing Problems, held August, 1930.” Papers and Discussions. Price **2s. 6d.**, post free.

* Out of print.

List of Publications—Continued.

- * "Reports received from Experiment Stations, 1929-30."
- "Memoirs of the Cotton Research Station, Trinidad." Series A. Genetics.
No. 2 Studies on the Inheritance of Corolla Colour and Petal Size in Asiatic Cottons. J. B. Hutchinson. 1931. Price **2s. 6d.**, post free.
- * "Reports received from Experiment Stations, 1930-31."
- * "Memoirs of the Cotton Research Station, Trinidad." Series A. Genetics.
No. 3. (a) Reversal of Dominance in the Interspecific Cross *G. barbadense* Linn. $\times$ *G. hirsutum* Linn. and its Bearing on Fisher's Theory of Dominance. (b) The Inheritance of Chlorophyll Deficiency in New World Cottons. S. C. Harland. (c) "Crumpled." A New Dominant in Asiatic Cottons produced by Complementary Factors. J. B. Hutchinson. 1932.
- "Memoirs of the Cotton Research Station, Trinidad." Series A. Genetics.
No. 4. The Inheritance of Anthocyanin Pigmentation in Asiatic Cottons. J. B. Hutchinson. 1933. Price **2s. 6d.**, post free.
- "Reports received from Experiment Stations, 1931-32." Price **2s. 6d.**, post free.
- "Memoirs of the Cotton Research Station, Trinidad." Series A. Genetics.
No. 5. Cytological Studies in Cotton. I. The Mitosis and Meiosis in Diploid and Triploid Asiatic Cotton. A. Skovsted. 1933. Price **2s. 6d.**, post free.
- "Memoirs of the Cotton Research Station, Trinidad." Series B. Physiology.
No. 4. Studies on the Transport of Carbohydrates in the Cotton Plant. Part III. E. Phillis and T. G. Mason. 1933. Price **2s. 6d.**, post free.
- "Reports received from Experiment Stations, 1932-33." Price **2s. 6d.**, post free.
- "Memoirs of the Cotton Research Station, Trinidad." Series B. Physiology.
No. 5. Further Studies on Transport in the Cotton Plant. I. Preliminary Observations on the Transport of Phosphorus, Potassium and Calcium. II. An Ontogenetic Study of Concentrations and Vertical Gradients. T. G. Mason and E. J. Maskell. 1934. Price **2s. 6d.**, post free.
- "Memoirs of the Cotton Research Station, Trinidad." Series A. Genetics.
No. 6. (a) Further Experiments on the Inheritance of the Crinkled Dwarf Mutant of *G. barbadense*. S. C. Harland. (b) Two Interspecific Hybrids between Asiatic and New World Cottons. A. Skovsted. 1934. Price **2s. 6d.**, post free.

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List of Publications—Continued.

- "Memoirs of the Cotton Research Station, Trinidad." Series A. Genetics.
No. 7. The Inheritance of Leaf Shape in Asiatic *Gossypiums*.
J. B. Hutchinson. 1934. Price **2s. 6d.**, post free.
- "Memoirs of the Cotton Research Station, Trinidad." Series B. Physiology.
No. 6. Studies on the Transport of Nitrogenous Substances in the
Cotton Plant. Part VI. "Concerning Storage in the Bark." T. G.
Mason and E. Phillis. 1934. Price **2s. 6d.**, post free.
- "Memoirs of the Cotton Research Station, Trinidad." Series A. Genetics.
No. 8. Further Experiments on the Inheritance of Chlorophyll
Deficiency in New World Cottons. S. C. Harland. 1934. Price **2s. 6d.**,
post free.
- "Conference of Workers on Cotton Growing Problems, held July, 1934."
Papers and Discussions. Price **2s. 6d.**, post free.
- "Progress Reports from Experiment Stations for the Season 1933-34."
Price **2s. 6d.**, post free.
- "A Review of the Work of the Experiment Stations, Season 1933-34."
J. C. Willis. Price **1s. 6d.**, post free.
- "Memoirs of the Cotton Research Station, Trinidad." Series A. Genetics.
No. 9. (a) Some New Interspecific Hybrids in the Genus *Gossypium* L.
(b) A Hybrid between *G. Davidsonii* and *G. Sturtii*. A. Skovsted. 1935.
Price **2s. 6d.**, post free.
- "Memoirs of the Cotton Research Station, Trinidad." Series A. Genetics.
No. 10. (a) Homologous Genes for Anthocyanin Pigmentation in New
and Old World Cottons. (b) A Third Series of Experiments with the
Crinkled Dwarf Mutant *G. barbadense* L.—The Cross *barbadense* crinkled
× *hirsutum* crinkled. (c) The Inheritance of Brown Lint in New World
Cottons. S. C. Harland. 1935. Price **2s. 6d.**, post free.
- "Memoirs of the Cotton Research Station, Trinidad." Series A. Genetics.
No. 11. "Chromosome Numbers in the Malvaceæ. I." A. Skovsted.
1935. Price **2s. 6d.**, post free.
- "Principles and Practice of Field Experimentation." J. Wishart and
H. G. Sanders. 1935. Price **3s.**, post free.
- "Memoirs of the Cotton Research Station, Trinidad." Series A. Genetics.
No. 12. The Inheritance of Fuzz and Lintlessness and Associated
Characters in Asiatic Cottons. J. B. Hutchinson. 1935. Price
2s. 6d., post free.
- "Progress Reports from Experiment Stations for the Season 1934-35."
Price **2s. 6d.**, post free.

List of Publications—Continued.

"A Review of the Work of the Experiment Stations, Season 1934-35."
J. C. Willis. Price 1s. 6d., post free.

"Memoirs of the Cotton Research Station, Trinidad," Series B. Physiology.
No. 7. Further Studies on Transport in the Cotton Plant. III. Concerning the Independence of Solute Movement in the Phloem. T. G. Mason, E. J. Maskell and E. Phillis. IV. On the Simultaneous Movement of Solutes in Opposite Directions through the Phloem. E. Phillis and T. G. Mason. 1936. Price 2s. 6d., post free. (*To be issued shortly.*)

"Memoirs of the Cotton Research Station, Trinidad." Series B. Physiology.
No. 8. Further Studies on Transport in the Cotton Plant. V. Oxygen Supply and the Activation of Diffusion. T. G. Mason and E. Phillis. VI. Interchange between the Tissues of the Corolla. E. Phillis and T. G. Mason. 1936. Price 2s. 6d., post free. (*To be issued in April.*)

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